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ERRATA.

Page 12 line 6 for " *Strenotroctes* " read " *Stenotroctes* "
,, 29 17 lines from end for " *unipunctana* " read " *unipunctata* "
,, 53 line 26 for " *argentina* " read " *argentata* "
,, 59 13 lines from end for " CARAMINI " read " CARIMINI "
,, 63 line 6 for " GRANDRUP " read " GANDRUP "
,, 101 ,, 30 ,, " *Diaretus* " read " *Diaeretus* "
,, 132 11 lines from end for " *coccidophthera* " read " *coccidophthora* "
,, 158 line 14 for " *Andansonia* " read " *Adansonia* "
,, 160 ,, 6 ,, " (I.) " read " (И.) "
,, 184 ,, 3 ,, " *Cyriopalpus* " read " *Cyriopalus* "
,, 269 ,, 33 ,, " *Orthesiopa* " read " *Ortheziopa* "
,, 279 4 lines from end for " (*Brachyrrhynus*) " read " (*Brachyrrhinus*) "
,, 296 line 28 for " xiv " read " xix "
,, 322 4 lines from end for " *Oligola* " read " *Oligota* "
,, 323 line 13 for " *melonella* " read " *mellonella* "
,, 342 ,, 18 ,, " *Anabasis aphylla*, which is identical " read " *Anabasis aphylla*. Anabasine is identical "
,, 380 ,, 17 ,, for " KRANCHE " read " KRANCHER "
,, 411 4 lines from end for " *Eucolaspis* (*Colaspis*) *brunnea* " read " *Colaspis brunnea*"
,, 438 line 29 for " *aenovirens* " read " *aeneovirens* "
,, 440 4 lines from end for " Dachivoro " read " Dacivoro "
,, 446 line 20 for " *Phyllanthis* " read " *Phyllanthus* "
,, 501 ,, 4 ,, " texmite " read " termite "
,, 508 ,, 36 ,, " *Cerotomegilla* " read " *Ceratomegilla* "
,, 522 ,, 34 ,, " *Tragicoschema* " read " *Tragiscoschema* "
,, 553 8 lines from end and page 554 line 14 for " xxi " read " xxxi "
,, 561 line 13 for " 10 " read " 40 "
,, 579 ,, 1 ,, " A. V. Gahan " read " A. B. Gahan "
,, 599 ,, 28 ,, " (*Calliephaltes*) " read " (*Calliephialtes*) "
,, 609 ,, 27 ,, " DIBBLE (C. R.) " read " DIBBLE (C. B.) "
,, 620 ,, 3 ,, " Friederich's " read " Friederichs' "
,, 655 ,, 6 ,, " CAINES " read " GAINES "
,, 660 14 lines from end for " SHEPHARD " read " SHEPARD "

IMPERIAL INSTITUTE OF ENTOMOLOGY.

REVIEW

OF

APPLIED ENTOMOLOGY.

SERIES A.

VOL. XXI.] [1933.

STEN (E. E.) & HUGHES (A. W. McK.). **Clothes Moths and House Moths. Their Life-history, Habits and Control.**—*Econ. Ser. Brit. Mus. (Nat. Hist.)*, no. 14, 56 pp., 20 figs., numerous refs. London, 1932. Price 6*d*.

The authors have collated in this pamphlet a good deal of information resulting from recent research on the subject of moths infesting clothing and household goods and the methods of dealing with them. The remedies or preventive measures suggested are in general suitable and practicable for household use rather than for large scale operations and expert technique. A key is given to the species of British clothes moths and house moths. Measures for prevention of infestation ude cold storage, sunning, brushing and beating, and mechanical protection, and instructions are given for dealing with upholstery and stuffed animals. The remedies suggested include treatment with various fumigants, heat, sudden changes of temperature and turpen- e.

PARKIN (E. A.). **Note on two Species of *Lyctus* (Powder-post Beetles) imported into Great Britain.**—*Ent. Mon. Mag.*, lxviii, no. 823, p. 277, 2 refs. London, December 1932.

Reference is made to the finding for the first time in England of *Lyctus cavicollis*, Lec. [*R.A.E.*, A, xx, 510]. It is not known how this American species came to be breeding in English ash. *L. sinensis*, Lesne, was also found in three consignments of Japanese oak sapwood sent to the Forest Products Research Laboratory in the summer of 1932. Since this species has come from a country with a temperate climate, it is possible that it will acclimatise itself in England, as *L. cavicollis* has apparently done, and will breed in seasoned English oak sapwood. The two common British species, *L. brunneus*, Steph., and *L. linearis*, Goeze, were also found in the same timber.

Whitehead (T.) & Currie (J. F.). **Virus Diseases in Relation to commercial Seed Potato Production. With a Study of the Aphid Population at selected Farms, by W. M. Davies.**—*Ann. Appl. Biol.*, xix, no. 4, pp. 529–549, 1 fig., 9 refs. Cambridge, November 1932.

An account is given of investigations during 1927–31 to test the suitability of fifteen localities in North Wales for the production of seed potatoes, with reference to the incidence of virus diseases and the deterioration of the stock by them. No increase in disease occurred in eight farms, with only a slight one in three, and the seed produced proved to be as good as that from Scotland.

The fact that virus diseases, particularly leaf-roll, did not increase at the more successful centres is not considered to be due to the scarcity of Aphids, including species that are known vectors, neither can it be attributed to the uninfective condition of the vectors present, as representative samples taken from potato crops transmitted leaf-roll to healthy plants in the laboratory. With one exception, no transmission occurred with any species of Aphid taken from apparently healthy plants in a partly diseased crop. In samples taken from plants infected with leaf-roll, transmission only occurred when *Myzus persicae*, Sulz., was included. The data suggest that the maintenance of health in potato stocks is influenced, not so much by the relative abundance of Aphids, as by the relation between the date of maximum infestation and the stage of maturity of the foliage. Annually in the more satisfactory localities the maximum infestation occurred later than in the less successful ones, and in the former the crops matured early or were prematurely cut down by blight. The relative movements of Aphids within the crops at the different centres is of importance, but this is influenced by many factors that are still under investigation.

Hamilton (M. A.). **On three new Virus Diseases of** *Hyoscyamus niger*. —*Ann. Appl. Biol.*, xix, no. 4, pp. 550–567, 3 pls., 6 refs. Cambridge, November 1932.

The following is largely taken from the author's summary: The source and general character of three new virus diseases occurring in fields of *Hyoscyamus niger*, grown commercially in Bedfordshire, are described under the names of *Hyoscyamus* virus (Hy.) II, III and IV. They have a host range of various solanaceous plants not including any variety of potato. Experiments showed that Hy. II and III are transmitted to and from all their hosts except tomato by the Aphid, *Myzus persicae*, Sulz. These two diseases have many characters in common and are probably closely related. Hy. IV is a different type of virus, and no insect vector has yet been found for it, negative experiments having been carried out with *M. persicae*, *Macrosiphum gei*, Koch, and *Thrips tabaci*, Lind. Problems arising from consideration of the data so far accumulated are discussed.

Buxton (P. A.). **Terrestrial Insects and the Humidity of the Environment.**—*Biol. Rev.*, vii, no. 4, pp. 275–320, 4 figs., 6 pp. refs. Cambridge, October 1932.

The following is taken from the author's summary: The gain and loss of water by insects is discussed, also the total amount of water in the insect's body.

The majority of insects do not drink, but rely largely on the water contained in their food. Insects that breed in dry material or live in deserts must be able to resist loss of water, and water formed in metabolism is of great importance to them. In the fasting mealworm (*Tenebrio molitor*, L.) metabolism is so adjusted as to produce as much water as is lost by evaporation ; this in turn is proportional to the saturation deficiency, at any rate at 23°C. [73·4°F.]. Several insects can gain water from an atmosphere that is nearly saturated. It is difficult to explain this on physical grounds ; the vapour pressure of the tissue fluids, including the liquid in the tracheoles, is so close to the saturation vapour pressure of water that condensation into the insect could only occur if the external atmosphere was within 1 per cent. of saturation. Perhaps there is a secretion of water into the body of the insect ; this explanation is difficult to accept at first sight, but such secretion would be no more remarkable than the activities of many types of gland.

Loss of water is partly by diffusion from the respiratory system. It also takes place from the surface of the body in some insects, but apparently not in all. It is known that the duration of life, or the loss of weight during starvation, of several insects is proportional to the saturation deficiency. This is only true within certain limits ; these are reached when the saturation deficiency is either very great or very small. Many insects can reduce their temperature below that of the surrounding air, at least when they are put in air that is fairly dry and above 20°C. [68°F.] ; this is presumably due to evaporation. The thermal death-point is also affected by evaporation. It may be lower in dry air, presumably owing to excessive loss of water ; or it may be higher in dry air, showing that the insect can cool its body by evaporating water—at any rate for a short period. Some insects do not lose water at all, and there is reason to believe that efficient cooling by evaporation is only possible for a relatively large insect ; a small insect, in which the ratio of surface to volume is great, gains so much heat by convection that, if it were to compensate by evaporation, it would die of dessication in a very short period.

Certain insects can maintain a particular proportion of water in the body even if external conditions change widely, but other insects lose a large proportion of their water without being killed. The normal water content alters with growth, metamorphosis, and other factors. In insects that normally hibernate, a large proportion of water is lost before dormancy. This in itself presumably lowers the temperature at which the tissues would freeze ; danger of death from freezing is also reduced in many insects by binding a large proportion of water to the colloids of the body. The maintenance of a due proportion of water in the insect is partly carried out by chemical methods, but it is also due in part to behaviour. Certain insects transfer themselves to regions of less evaporation when the air is dry, or when a material proportion of water has been evaporated from their bodies.

The existence of an insect in a very damp atmosphere, which is the normal environment of many of them, depends on the excretion of water through the malpighian tubes, and on the passage of damp faeces. But a large number of insects, even among those that require a moist environment, are killed by exposure to saturated air. It is supposed that insects can only exist under very dry conditions if they possess several qualities in combination. Loss of water from the alimentary canal must be almost nil ; this is assisted by the excretion of

solid uric acid and by efficient extraction of water from the contents of the hind gut. Certain insects also appear to reduce the loss of water through the skin to a very low figure. It is assumed that they have no control of the diffusion of water from within their tracheal system.

The relation of a particular insect to atmospheric moisture is often very precise; moisture must often be a determining factor. The conditions that are most favourable may perhaps be thus defined. If low humidity is unfavourable, then the higher the humidity the better, up to the point where elimination becomes impossible; in fact, the optimum is just below the point of danger. Similarly, if growth and reproduction are to be as rapid as possible, the temperature must be just under that which is harmful.

The insect egg may be regarded as a separate problem. Certain eggs can tolerate a considerable loss of water from their contents. In some eggs, at any rate, loss of water is directly proportional to saturation deficiency. The eggs of many insects occur normally in places where the humidity is very high; most of them do not suffer from exposure to saturated air, though a few are known to do so. Air that is too dry sometimes causes the death of the embryo, at others it renders the egg-shell so hard that hatching is impossible. Certain eggs tolerate dryness, which causes them to become dormant. They fall into two classes. In one class, toleration to drying may occur early or late in development, and the embryo itself loses water. In the other, dryness is only tolerated when the egg is ready to hatch; the larva within it does not lose water, but the shell of the egg becomes water-tight. In many insects, exposure to a low, but not fatal, degree of humidity increases the duration of the egg stage.

Carroll (J.) & McMahon (E.). **Winter Spraying of Orchards with particular Reference to the Control of Red Mite and Apple Capsid Bug.**—*J. Dept. Agric.* [*Irish Free State*], xxxi, no. 2, pp. 190–198, 2 refs. Dublin, 1932.

Work on winter sprays (Carbokrimp, Sunoco and Winter Volck) against pests of apple, begun in 1928 in Dublin, was continued during 1931 under conditions similar to those prevailing in former years [*R.A.E.*, A, xviii, 23, 669]. The mineral oil sprays were tested alone and in combination with the tar distillate, and two proprietary combination sprays were also used. The results of the laboratory experiments, although less favourable for all sprays than in 1930, show clearly that the combination oil and tar-distillate sprays give a very satisfactory degree of control of eggs of *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.), as well as those of Aphids and the apple sucker [*Psylla mali*, Schm.]. The oil sprays alone were less effective, even in the case of *P. pilosus*. At 4 per cent., neither was efficient in killing the eggs of Aphids and *Psylla*, and over 30 per cent. of those of the mite hatched. The results of the orchard experiments were in agreement with those of the laboratory tests. The question of winter spraying is discussed. The use of combination oil and tar distillate sprays at a concentration of 10 per cent. is recommended in orchards where *Paratetranychus* is present. A home-made spray containing 4 per cent. of the oil constituent and 6 per cent. of the tar-distillate may be used, some water being added to each before mixing. Application should be made not later than the end of January and before there is any sign of the buds swelling. In spite of thorough spraying, at

least 10 per cent. of the eggs of *Paratetranychus* will hatch, so that in orchards where this mite is present it will be necessary to spray each winter.

Plesiocoris rugicollis, Fall., although not at present a serious pest in the Irish Free State, as it is in Northern Ireland and in Britain, is present in a few orchards and appears to be spreading. This Capsid feeds on the young leaves of apple and later attacks the young fruits, which become mis-shapen and undersized, blotches and cracks forming around the punctures. It hibernates in the egg stage, the eggs being inserted into the tissue of the bark so that they are invisible and well protected. They can, however, be reached by sprays through the small holes left immediately above them in the bark. The results obtained in England in attempts to control *P. rugicollis* with certain tar distillates and oil sprays are briefly discussed [*R.A.E.*, A, xviii, 626 ; xix, 607 ; xx, 549, 550]. An extensive orchard trial with a number of such sprays in eastern Ireland in 1931 gave very disappointing results. The efficiency of tar distillate sprays, which cannot be applied after the end of January, depends on their ability to seal up the holes in the bark over the eggs, and as these do not hatch until at least 3 months later, it is unlikely that the film of spray can be maintained long enough to be effective, particularly during a rainy spring such as that of 1931. It is therefore proposed to test the efficiency of oil sprays applied just before the buds open.

MARCHAL (P.) & FOEX (E.). **Rapport phytopathologique pour l'année 1931.**—*Ann. Epiphyt.*, xviii, no. 1, pp. 1–53, refs. Paris, 1932.

This report includes notes on the organisation of the campaign in France against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], which has considerably increased in numbers, the infestation having spread in 1931 over 37 Departments as compared with 21 in 1930 [*R.A.E.*, A, xix, 696 ; xx, 666]. Recent work on insecticides and fungicides is briefly reviewed, and notes are given on a number of insect pests observed during 1931, with references to the papers published on the various subjects dealt with. A severe outbreak of the nun moth, *Lymantria monacha*, L., the first recorded in France, occurred in a spruce forest in Savoy covering an area of about 25 acres. The larvae entirely defoliated the trees, so that a number of them died from starvation ; the last adults disappeared at the end of August. The authors believe that though this moth prefers spruce to other trees, it is an insect of the deciduous forest zone, and only attacks spruce when it is planted within this zone [*cf.* xix, 510, 662]. A serious outbreak of the Tortricids, *Tortrix* (*Cacoecia*) *murinana*, Hb., and *Enarmonia* (*Steganoptycha*) *rufimitrana*, H.-S., occurred on *Abies pectinata* in the Vosges (Alsace).

Rapports sommaires sur les travaux accomplis dans les laboratoires en 1931.—*Ann. Epiphyt.*, xviii, no. 1, pp. 54–96, refs. Paris, 1932.

In this report individual surveys are included of the work done during 1931 in the laboratories of various entomological stations in France, much of which has already been noticed.

In the campaign against the Colorado potato beetle [*Leptinotarsa decemlineata*, Say], described by P. Marchal, dusts containing arsenicals applied in May and July proved as effective as sprays. In experiments

by P. Vayssière, it was found that vacuum fumigation with 300 cc. carbon bisulphide per cu. m. did not affect potato tubers, this treatment being known to be more than sufficient to kill *L. decemlineata*. In the fumigation of carnations infested with *Tortrix pronubana*, Hb., all stages of the moth were destroyed, and the colour and scent of the flowers were unaffected, after an exposure of two hours to either 300 cc. carbon bisulphide or rather more than 125 cc. tetrachlorethane per cu. m. In order to check the increase of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental peach moth) in the Alpes-Maritimes [*R.A.E.*, A, xix, 85], A. Balachowsky arranged for the introduction of its Braconid parasite, *Macrocentrus ancylivora*, Rohw., from the United States. Three consignments were received in the spring of 1931, and 1,049 adults were liberated in three localities in the first half of July and the first half of August. Examination a fortnight after each liberation showed a rate of parasitism varying from 10 to 50 per cent., and it is hoped that establishment has been secured.

From the Bordeaux Station J. Feytaud reports that the studies of *L. decemlineata* have been continued [xx, 4] ; it has now been found that overwintered adults may survive starvation for a period of up to seven months ; hibernating beetles of the second generation of 1930, isolated in March 1931, were still alive in October and entered the soil a second time, without having had any food. The adults and larvae were frequently attacked by *Staphylinus* (*Ocypus*) *olens*, Müll., the Carabid, *Calathus melanocephalus*, L., and the praying mantis [*Mantis religiosa*, L.]. In the course of further observations on the Pyralid, *Dioryctria splendidella*, H.-S., on *Pinus maritima* [xix, 124], active females of the Coccid, *Palaeococcus* (*Monophlebus*) *fuscipennis*, Burm., and cocoons enclosing males were found on the infested trees near the exuded clots of resin.

From Alsace, Méneret reports that successful control of the mole-cricket [*Gryllotalpa gryllotalpa*, L.] has been obtained in experiments with baits of rice and zinc phosphide [xviii, 45, etc.].

FEYTAUD (J.). **Recherches sur le Doryphore** (*Leptinotarsa decemlineata*, **Say**).—*Ann. Epiphyt.*, xviii, no. 2–3, pp. 97–220, 4 pls., 15 figs., refs. Paris, 1932.

These studies are a continuation of previous ones [*R.A.E.*, A, xii, 140] and cover the years 1923–30. The measures tested against *Leptinotarsa decemlineata*, Say (Colorado potato beetle) are fully described, and the general practices followed in France are discussed [*R.A.E.*, A, xx, 666]. The fact that *L. decemlineata* descends to the soil for pupation and also for rest periods in winter or summer renders soil treatment an important measure of control. Of a large variety of disinfectants tested, excellent results were obtained with hydrocarbons (kerosene, petrol and benzene), chloropicrin and carbon bisulphide, the last-named being the most suitable for general use. Foliage treatment will doubtless continue to be the only operation that will permit of a good crop being obtained in spite of the presence of the pest, but spraying should be preceded by careful hand-collection, and soil treatment should be applied in any spot where infestation is established, if it cannot be under constant supervision. The creation of a fresh centre of infestation is generally due to the oviposition of one or a few females within a small area. If the soil is fairly friable, the mature larvae pupate there, so that within 30 or 35 days a few hundred adults

may be produced, and in the case of an attack beginning in spring several acres may be infested within a year, fresh infestations also arising at distances of a few miles in the direction most favourable for flight. If a single adult is found, a thorough search should be made of the vicinity every day for at least a week and every 4th or 5th day for at least a month longer, before returning to the normal system of supervision. If the infestation covers the space of a few feet, and eggs, young larvae and a few winged adults are found, giving the impression of a very recent attack, hand collection should be thoroughly done until all are destroyed and should be followed by a foliage treatment, especially on the plants surrounding those attacked; the plants should be examined every day and sprayed each week until every insect has disappeared, and watch should be kept all through the season and again in the following spring. The possible establishment of the beetle is indicated by the discovery of mature larvae only, and if mature larvae and adults are found together, or if young larvae are present over a considerable area, then the infestation is certainly established. In these cases, collection should be practised every day and spraying each week (always preceded by collection), until all the insects are killed, and the soil should also be treated by injection of carbon bisulphide or spraying with a hydrocarbon, at least in any places in which watch cannot be kept constantly for emergence or which, owing to their position, are particularly dangerous. Whatever the importance of the infestation, watch should be kept until the spring of the next year and cultural practices should be followed as a precaution, with preventive treatments in the vicinity. These measures are successful in eradicating *L. decemlineata* wherever they are properly carried out, and the results are evident very quickly in the case of attacks in fresh areas and more slowly, but none the less surely, in the case of more severe infestations. Examples are given of many areas that have been cleared in this way, showing 75 communes that have been cleared out of 209 attacked by the beetle between 1922 and 1927 inclusive. Failure to declare infestations and delay or inefficiency in remedial measures are the two great factors against success.

Coulon (L.). **Les insectes des arbres résineux.**—*Bull. Soc. Sci. nat. Elbeuf*, xlviii (1929), pp. 87–112; xlix (1930), pp. 87–94; l (1931), pp. 77–88. Elbeuf, 1929–32.

This is a list of the insects found on conifers in France, with their parasites.

Butovitsch (V.). **Der Larvenfrass von** *Brachyderes incanus.* [The larval Feeding of *B. incanus.*]—*Allg. Forst- u. Jagd-Ztg.*, cviii, no. 3, pp. 91–94, 1 fig. Frankfurt a.M., 1932.

The scanty published information regarding the feeding habits of the larva of *Brachyderes incanus*, L., is briefly reviewed, and notes are given on recent observations in Germany. In July 1930 the larvae of this weevil were feeding on the roots of pines 8–10 years old, and in July 1931 serious injury was done to the roots of oaks and 1-year-old pines in a nursery surrounded by stands of pines 5 years old. The tap-roots of the pines were stripped of their bark, lateral roots being also injured. As feeding on young trees appears to be unusual, it is suggested that adult weevils from an old stand had migrated to the

5-year-old pines and had then oviposited in the nursery. In studies on soil fauna, larvae of *B. incanus* were abundant in an old stand of pines, less numerous in recently felled and replanted clearings, and absent from newly established plantations.

Scheibe (K.). **Die Rübenblattwanze und ihre Bekämpfung.** [The Beet Leaf Bug and its Control.]—*Die kranke Pflanze,* ix, no. 9–10, pp. 91–94, 1 pl. Dresden, 1932.

In the autumn of 1932 *Piesma quadrata,* Fieb., was found attacking beet in north-eastern Saxony, having spread from Anhalt and Silesia. The leaf-crinkle caused by it had been observed for 3–4 years previously without its presence being suspected. Beets in light, sandy soil suffered more or less severely, those in heavy soil being untouched [*cf. R.A.E.*, A, xvi, 1 ; xvii, 684]. The method of control advocated is that of sowing narrow trap strips of beet as early as possible. When the bugs that have gathered on them begin ovipositing, they should be dusted with an insecticide and ploughed under deeply, the ground being then harrowed and well rolled.

Helm (A.). **Die Birnengallmücke** (*Contarinia pyrivora* **Ril.).** [The Pear Gall Midge.]—*Die kranke Pflanze,* ix, no. 9–10, pp. 99–100. Dresden, 1932.

Contarinia pyrivora, Riley, is developing in Saxony from an occasional pest to one of prime importance, about 90 per cent. of the pear trees in some localities being infested in 1932.

Speyer (W.). **Beitrag zur Bekämpfung des Apfelblütenstechers mit Hilfe von Fanggürteln.** [A Contribution to the Control of the Apple Blossom Weevil by means of Trap Bands.]—*Die kranke Pflanze,* ix, no. 9–10, pp. 96–99. Dresden, 1932.

In experiments in the fruit-growing district of the Lower Elbe during July–December against *Anthonomus pomorum,* L., which the author considers injurious in certain circumstances [*cf.* next paper], the ordinary corrugated cardboard trap band caught many more pests and fewer beneficial insects and spiders than a proprietary one. In some years, trap bands of straw proved superior to those of corrugated cardboard, and in others inferior. Fewer pests were caught when the trunks were scraped prior to applying the bands. *A. pomorum* outnumbered all the other pests in the bands.

Werth (E.) & Klemm (M.). **Apfelblütenstecherbefall und Ernteergebnis.** [Infestation by the Apple Blossom Weevil and the Crop Yield.]—*NachrBl. deuts. PflSchDienst,* xii, no. 11, pp. 87–88, 1 fig. Berlin, November 1932.

From observations during 10 years the authors concluded that the apple blossom weevil [*Anthonomus pomorum,* L.] was of negligible importance [*R.A.E.*, A, xx, 342, etc.], a view opposed by Trenkle [xix, 615]. The findings of other workers [*cf.* xx, 233, 481] are discussed in support of the authors' view.

VIMMER (A.). **Ueber die Larven kleiner Fliegen, welche in der Tschechoslovak. Rep. durch Ausnagen von Hyponomen den Pflanzen schaden.** [On the Larvae of small Flies that damage Plants in Czechoslovakia by mining in them. (*In Czech.*)]—*Arch. přírodov. Výzk. Čech.*, xviii, no. 1, pp. 1–159, 22 pls., 18 refs. Prague, 1931. (With a Summary in German.)

This account of the leaf-mining Diptera that occur in Czechoslovakia includes keys to the families, genera and species, with descriptions of the larvae and the mines they cause and of the pupae and some of the adults.

[TZIOPKALO (V. L.).] **Циопкало (В. Л.). Ueber die Methodik der Flugzeugbekämpfung der Forstschädlinge.** [The Aviochemical Method in the Control of Forest Pests (*in Russian*).]—*Staatsinst. wiss. Forsch. Geb. Forstw. Holzind., Wiss. Ausgab.*, no. 21, 52 pp., 27 figs., 1 graph, 1 map, 70 refs. Kharkov, 1931. [Recd. November 1932.]

The history of the use of aeroplanes for dusting against forest pests in various parts of the world is briefly reviewed, and notes are given on the kinds of insects that can be controlled by this method, and the conditions under which it would be economically justified. Chapters are devoted to the physical properties of the various insecticides and their effects on insects, domestic animals, the vegetation and the soil, and to technical points connected with the work. The latter include the preliminary examination of the area to be treated ; the choice of a suitable type of aeroplane ; the method of marking the ground over which it has to fly ; the determination of the amount of the insecticide required and the height from which it should be applied ; and the estimation of the mortality of the pest after treatment. The cost per acre is discussed, and it is shown to be much lower than that of removing litter or applying adhesive bands to the trees.

[PRINTZ (Ya. I.).] **Принц (Я. И.). Notes on Vine Pests. III.** [*In Russian.*]—136 pp., 4 fldg. charts, text-ill., 5 refs. Helenendorf, Ent. Kab. Koop. Vinogr. " Konkordiya." Tiflis, Izd. Tekhnika i Shroma, 1932. Price *Rub.* 3.

Further observations on vine pests in Transcaucasia [*cf. R.A.E.*, A, xvi, 607] were made during 1928–30. Laboratory investigations showed that 11–12°C. [51·8–53·6°F] is the minimum temperature at which larvae of the Melolonthid, *Polyphylla olivieri*, Lap., start feeding on vine slips ; in the field this occurs in the second half of April, and the vines begin to wither in the first week of May. The larvae are particularly active in May and August–September. Those of the first instar moult in the second year of their life, after which about 35 per cent. live two years before moulting again, and about 60 per cent. of those of the third instar do not pupate until after another two years. Thus the life cycle may extend over 3–5 years. Observations in a thermostat showed that the duration of the individual instars does not depend on temperature. It was found possible to determine the prevalence of the beetles in a given locality by catching males in traps consisting of a large tin funnel having in the centre a small wire cage in which a newly emerged female has been placed. The traps were fixed about 5 ft. from the ground, which is the height at which the adults usually fly. The male beetles are attracted from distances of over 750 yards. They strike against shields placed round the cage and fall

through the funnel into a jar below. The captive females were fed on fresh cypress needles and lived 6–7 days. The beetles become active immediately after sunset on calm and cloudless evenings, and experiments showed that a certain degree of twilight is a stimulus to flight [*cf.* xvi, 656]. Flight does not occur at temperatures below 13°C. [55·4°F.]. Cypress was the favourite food-plant of the adults, but the larvae did not touch it, preferring the roots of grasses growing among the trees. Oviposition lasts about a week, the eggs being laid at depths varying from 2 to 14 ins., the majority at 8–10 ins. The pupae occur at a depth of about 4 ins. and may easily be destroyed by turning the soil over in June. This should also be done in October and April to collect the larvae, which are then near the surface [*cf.* xv, 126]. Artificial or green manures should be used in preference to dung. Experiments in soil fumigation with carbon bisulphide were continued [xvi, 608], two parts being used with one of paradichlorobenzene. Applied at the end of June at the rate of 1·8 oz. to the square yard, this mixture killed 75 per cent. of the larvae in 12 days, and all were killed when the dosage was increased to 2·1–2·4 oz. Carbon bisulphide applied alone in late October at the rate of 3·6 oz. to the square yard did not damage the vines and killed all the larvae, the temperature of the soil being 16°C. [60·8°F.].

The possibility of applying soil fumigants for the control of *Phylloxera* in Azerbaijan is discussed at length, and the preliminary work carried out in connection with the cultivation of vines grafted on American stocks is reviewed.

Details are given of investigations on the effect of temperature on *Pseudococcus citri*, Risso. It had three generations a year, and in 1928 and 1929 a partial fourth. At temperatures below −14°C. [6·8°F.] all the hibernating mealybugs were killed. The cold rainy weather in the summer of 1928 and the severe spring of 1929 greatly decreased the productiveness of the Coccids, which were present in limited numbers only and laid 3–40 eggs each ; as, however, the summer of 1929 was dry and hot, as many as 250 eggs were deposited by females in August. Climatic conditions subsequently continued to be favourable to the insect, and a severe outbreak occurred in several localities in 1930, the whole crop being destroyed in some vineyards. Females feeding on the fruit lay a considerably greater number of eggs than those occurring on the leaves.

The study of the bionomics of *Erythroneura* (*Zygina*) *parvula*, Boh. [xv, 127] has been continued. Hibernation occurs in the adult stage, and there are four generations a year. Early in the spring the Jassids occur on various weeds and parsley, which is their favourite food-plant, and in the second half of April infest vines, which, however, they abandon about mid-May. The first generation eggs are probably laid on weeds, but as these become dry and scorched by the sun, the Jassids return to the vines in the first half of June, remaining on them till late autumn. The egg stage lasts about a week, and the adult stage is reached 3 or 4 weeks later. The adults become sexually mature in 16 days under laboratory conditions.

Much of the information given on *Tetranychus* (*Epitetranychus*) sp. has already been noticed [xv, 126]. The mites chiefly attack varieties of vine with smooth or only slightly hairy leaves. Oviposition begins in early May, and by the end of September nine generations have been produced. Excess of humidity does not affect the number of generations, but reduces the number of mites in each. The eggs hatch in

5–6 days, and the life-cycle is completed in 15–20. The effectiveness of dusting with sulphur depends on the temperature, in the laboratory the dust killed the mites in 2 hours at 34°C. [93·2°F.], in 5–6 hours at 28°C. [82·4°F.], and in 4–5 days at 26°C. [78·8°F.].

In Azerbaijan, the Tortricid, *Polychrosis botrana*, Schiff., has three generations a year. In spring the first adults usually appear after the first 10–15 days during which the temperature has remained at or above 10°C. [50°F.]. A considerable number of eggs do not hatch, as all those laid on fruit exposed to the direct rays of the sun become shrivelled. The larvae of the first and second generations hatch about 21st May and 7th July, respectively, and reach maturity in about 40 days ; those of the third hatch about 1st September and remain on the vines till the harvest, which begins about 10th October. Notes are given on the results of experiments with various insecticides. In dry weather, the best results were obtained with proprietary arsenical dusts, but in rainy weather, these are liable to be washed off.

BODENHEIMER (F. S.). **Überblick über die Gesamtökologie der Afrikanischen Wanderheuschrecke** *Schistocerca gregaria*, **Forsk.** [General Ecology of *S. gregaria*.]—*Biol. Zbl.*, lii, pt. 9–10, pp. 598–619, 2 figs., 17 refs. Leipzig, 1932.

It has long been held that the permanent breeding places of *Schistocerca gregaria*, Forsk. (desert locust) must occur in, or near, the French and Anglo-Egyptian Sudan, southern Arabia and the Deccan. All these areas represent parts of the Sudano-Deccanian botanical sub-region, the climate of which is characterised by a mean annual temperature of from 25 to 29°C. [77–84·2°F.] and by a moderate amount of rain, which falls in summer. It is only within this sub-region that the solitary phase of the locust regularly occurs and the formation of the swarming phase is possible. The Eremian region (comprising the Sahara, most of Arabia, Mesopotamia, Persia and Baluchistan) is subject only to invasions and temporary breeding.

The swarming phase may have 2 or 3 generations in a year. The first is produced in summer in the Sudano-Deccanian sub-region, and the swarms migrate into the Eremian region, where the winter rains enable them to breed again. This second generation migrates further north and may breed again during spring rain, the progeny returning south into the Sudano-Deccanian permanent areas. The directions of the migrations coincide with those of the prevailing winds of the seasons in which they take place.

There appears to be no obligatory imaginal diapause in *S. gregaria*, and the maturation and deposition of eggs are due to favourable external conditions. It is possible that their maturation may be connected with feeding on sprouting grass rich in vitamins. Outbreaks occur as a result of a coincidence of optimum conditions for breeding in the permanent and the temporary breeding areas, and a failure of rains in the temporary areas may induce a collapse of the cycle.

PASSMORE (F. R.). **A Survey of Damage by Insects and Moulds to West African Cacao before Storage in Europe. Season 1930–31.**—*Bull. Imp. Inst.*, xxx, no. 3, pp. 296–305, 6 refs. London, October 1932.

Examination of cacao beans damaged by insects previous to importation into England from West Africa has confirmed earlier conclusions

of the importance of *Ephestia elutella*, Hb., and *Araecerus fasciculatus*, DeG. [*R.A.E.*, A, xviii, 174]. *E. elutella* and *E. cautella*, Wlk., were responsible for 46·8 per cent. of the damage. Of the 763 beans examined, the insects responsible for the damage to 294 could not be identified. The others found in order of frequency of occurrence were six species of Psocoptera, including *Strenotroctes minor*, Pearman, and *Deipnopsocus spheciophilus disparilis*, Pearman [*cf.* xix, 721], *Laemophloeus minutus*, Ol., *Carpophilus* spp., *Tribolium castaneum*, Hbst., *Lasioderma serricorne*, F., *Dermestes* spp., *Silvanus* (*Oryzaephilus*) sp., and *Microbracon* sp. The relation, if any, between insect infestation and moulds was not discovered, though many beans gave evidence of both insect and fungus attack. It is probable that infestation by mites is extensive, but no details were obtained.

ANDREWS (E. A.). **Caterpillar Pests of the Tea Plant, and of Green Manure Plants and Shade Trees in Use on Tea Estates. Parts I–III.** —*Quart. J. Sci. Dept. Ind. Tea Ass.*, 1929, pt. 3, pp. 134–145, 2 refs.; 1931, pt. 3, pp. 129–138; pt. 4, pp. 189–202, 2 refs. Calcutta, 1929–32.

The first of this series of papers gives a general account of the development and characteristics of the various stages of Lepidoptera, and the second and third describe the bionomics of *Biston suppressaria*, Gn. (looper caterpillar) and *Andraca bipunctata*, Wlk. (bunch or cluster caterpillar) on tea in India, with brief notes on their control.

CORBETT (G. H.). **Insects of Coconuts in Malaya.**—*Gen. Ser. Dept. Agric. S.S. & F. M. S.*, no. 10, 106 pp., 19 pls., 33 refs. Kuala Lumpur, 1932. Price $1·50.

This bulletin is the first of a series dealing with the morphology, bionomics and control of the insect pests of major crops in Malaya, and is compiled for the use of planters. An elementary outline is given of the structure of insects, with a brief summary of the characters of those orders representatives of which are discussed. The major and minor pests of the living and dead tissue are listed according to the parts of the coconut palm they attack and are then discussed individually, the more important ones in some detail, under the orders to which they belong.

JARVIS (E.). **The Biological Control of Cane-grubs.**—*Trop. Agriculture*, ix, no. 11, pp. 331–333, 8 figs. Trinidad, November 1932.

A brief general account of the life-cycle of Scoliids is given, and a simple method employed for breeding them on Lamellicorn larvae that destroy sugar-cane in Queensland is described. In order to reproduce natural conditions for oviposition, which takes place in the ground under moist conditions, various cages were tested, the best being a stout tin, about 5 inches high by 4 inches in diameter, with a cover of copper gauze to provide ventilation. The soil used is sifted through $\frac{1}{8}$ in. mesh, sterilised and moistened. About an inch depth of slightly consolidated soil is placed in the tin, and an active Lamellicorn grub is enclosed in a depression made against the side by covering it with a couple of cakes of soil made compact by pressing in the hand. About 3 inches of soil are then added and pressed down gently so as to secure less firmness near the surface than at the bottom. A few drops of honey and water are placed on a leaf laid on the top of the soil before

introducing the female parasite. Three females of *Campsomeris tasmaniensis*, Sauss., have lived for 48, 51 and 75 days, respectively, under this treatment, and have laid 34, 65 and 25 eggs. The cage is emptied daily, the grub with a parasite egg removed and a fresh one inserted, another leaf with food supplied and the wasp again confined.

Grubs collected for this purpose are kept in separate tins of soil, as they are likely to attack one another if confined close together. These tins are about 3 inches high by $2\frac{1}{2}$ inches in diameter without perforation of the metal top so as to retard evaporation from the soil. The parasitised grubs must be carefully examined for mites before being transferred to the breeding tray. These can be removed with the wet point of a small sable brush. The parasitised grubs are stored in wooden trays 3 ins. deep, and filled to within 1 inch of the top with sifted moist soil, slightly consolidated by pressure, and covered with a sheet of glass. Cells are impressed in the soil with a wooden die, and a grub is laid on its back in each of these, the parasite larva lying during growth on the ventral surface of the host. Inspection for mites should be made daily. Grubs that die after the hatching of the parasite should be at once removed and the cell searched for mites. Both eggs and larvae of the Scoliids are subject to attack by fungi and bacteria.

The Scoliid larvae mature in 7–10 days. The cell is then roofed over with a piece of tin or cardboard $1\frac{1}{2}$ ins. square, bent to form an angle of 60 degrees, to provide a point of attachment for the silk envelope that contains the cocoon and pupa. After 3–4 days the cocoon is transferred to a paper tube 12 ins. long and $\frac{5}{8}$ in. in diameter, tied at one end and closed at the other by flaps made by 6 longitudinal cuts $\frac{1}{4}$ in. long. These tubes are kept in a tin receptacle with a layer of moist sand at the bottom. A glass test tube projects through a hole in the tin about the level of the sand for the emerging wasps to enter. The best conditions to maintain in the storage tin are dampness varied by a day or two of dryness. The paper tubes may be dried and replaced in the tin a few hours before supplying additional moist sand. The cocoons should be inspected at intervals for mould or entomogenous fungi, and those showing any appearance of damp should be moved to fresh cartons and allowed to dry before being replaced. If the pupae have not produced adults after two months or appear likely to overwinter, it is advisable to provide ventilation in the storage tin by replacing part of the bottom by copper gauze.

A decrease in mortality of from 60 to less than 10 per cent. has been effected by selecting grubs for hosts from soils in which mite infestation is negligible.

MUGGERIDGE (J.). **Spread of *Pieris rapae* Butterfly and Progress of Parasite Work.**—*N. Z. J. Agric.*, xlv, no. 3, pp. 132–135, 3 figs. Wellington [N.Z.], 20th September 1932.

During 1931–32, *Pieris rapae*, L., which is very destructive to cabbages and other crucifers in New Zealand, where it has recently become established [*cf. R.A.E.*, A, xix, 619 ; xx, 352], was found at a distance of 130 miles from the initial point of infestation in North Island ; it has also been discovered in one locality in South Island. A total of 1,200 adults of its parasite, *Apanteles glomeratus*, L., emerged from a consignment of pupae received from England [*cf.* xx, 352]. Of these, 870 were used for breeding purposes, 270 died in the emergence boxes, and 60 were liberated in the field. The most successful

method of rearing the parasites was to confine the adults as closely as possible with an abundance of host larvae on their natural food-plant ; liberations in a large space, such as an insectary, resulted in very little parasitism, as large numbers of the parasites concentrated on the roof. The manner in which the host larvae are attacked is described ; only those of the early instars were observed to be parasitised. The parasite larvae emerged from those of the host 20–28 days after oviposition, after the latter had migrated to a suitable place for pupation. The number emerging from one host varied from about 18 to as many as 50. Most of the parasites reared under glasshouse conditions are being kept in cold storage for liberation during the 1932–33 season.

Clausen (C. P.), Gardner (T. R.) & Sato (K.). **Biology of some Japanese and Chosenese Grub Parasites (Scoliidae).**—*Tech. Bull. U.S. Dept. Agric.*, no. 308, 26 pp., 8 figs., 14 refs. Washington, D.C., May 1932. [Recd. November 1932.]

In the course of investigations during 1920–28 on the natural enemies of *Popillia japonica*, Newm., the habits of Scoliids attacking the larvae of this beetle and those of other Rutelids and Melolonthids were studied. For comparative purposes only those from Japan and Korea, including *Scolia japonica*, Smith, *Campsomeris annulata*, F., and 15 species of *Tiphia*, are dealt with, though occasional notes are given on certain Chinese and Indian species and on observations of various authors on other Scoliids. A generalised account, illustrated throughout by notes on individual species, is given of various aspects of the bionomics of these parasites, including host relationships, life-cycle, habits of all stages and natural enemies.

The following is almost entirely taken from the authors' summary : The food of the adults consists of the secretions of Homoptera, including those of Aphids and Coccids, certain blossoms, and nectar from various glands associated with foliage. The distribution of a given species can therefore accompany that of its host only so far as the range of its particular food-supply extends. Observations show that in *Scolia* and *Campsomeris* there is a marked tendency among the males to swarm at night. This habit has not been observed in *Tiphia*. Paralysis of the host is permanent in the case of *Scolia* and *Campsomeris* and is only temporary in *Tiphia* ; when attacked by the first two, the host larva is buried more deeply than its normal feeding level. In *Scolia* and *Campsomeris* the egg is placed perpendicularly upon the ventral surface of the abdomen of the host, whereas in *Tiphia* it is laid transversely in a segmental or intersegmental grove, and either dorsally on the thorax or ventrally between any two segments. Its position varies with the species but is constant for each. In *Scolia* and *Campsomeris* the anterior portions of the body of the larva are thrust into the feeding puncture, and no portion of the integument is eaten, whereas in *Tiphia* feeding is suctorial and the larva consumes all but the head and the more heavily chitinised portions of the thorax following the completion of feeding upon the body fluids. The characters distinguishing the cocoons of *Scolia* and *Campsomeris* from those of *Tiphia* are discussed.

Of the natural enemies recorded, all were observed in Assam, except the Sphegid, *Palarus saishiuensis*, Okamoto, which occurs in Korea and stores its nests with adults of *Tiphia* and other wasps of similar size. Two species of *Mutilla* and one of *Perilampus* were reared from

the cocoons of *Tiphia*, though in very small numbers. Of four species of Bombyliids reared from cocoons of *Tiphia*, *Hyperalonia oenomaus*, Rond., which is the only one that occurs in large numbers, annually parasitised 50–65 per cent. of the cocoons of an undetermined species of this genus and was also obtained from those of *Scolia* and *Campsomeris*. The Rhipiphorid, *Macrosiagon pusillum*, Gerst., was found quite frequently in the cocoons of *T. pullivora*, Allen & Jaynes, and the Nematode, *Eomermis tenuissima*, was reared occasionally during the summer from those of this species and of *T. matura*, Allen & Jaynes.

Kaburaki (T.) & Imamura (S.). **A new Mermithid-worm parasitic in the Rice Borer with Notes on its Life History and Habits.**—*Proc. Imp. Acad.*, viii, no. 3, pp. 109–112, 6 figs. Tokyo, March 1932.

The larvae of *Chilo simplex*, Butl., from the district of Numazu examined in 1930 were found to be attacked to the extent of about 76 per cent. by a Mermithid, *Amphimermis zuimushi*, gen. et sp. n., which is here described. Infestation generally occurs in the second generation larvae, which the parasites leave about the time of the rice harvest in October or November. After emerging, the worm makes its way into the soil, passing through the hole in the rice stem made by the borer or through the cut end, its exit from its host killing the latter. It hibernates in the soil at a depth of about 12 ins. and matures during the winter, moulting once. Pairing occurs in late spring and oviposition from the end of June to late autumn, chiefly late in the summer, vast numbers of eggs being laid. The larvae hatch in about three weeks and swim rapidly on the surface of the irrigation water in the rice-fields. They make their way through the hole made by the borer in the rice plant and enter the host, infestation appearing to take place generally at night. The Nematodes grow rapidly within the host, where they remain for 2–4 weeks, the females rather longer than the males.

In cases of very low parasitism per individual host, the female only occurred, the percentage of males increasing with the number of worms per individual, and it is suggested that the sex of the parasite may depend on the amount of food available [*cf. R.A.E.*, A, xx, 667].

Pemberton (C. E.). **Control of the Nutgrass Armyworm with arsenical Dusts.**—*Hawaii. Plant. Rec.*, xxxvi, no. 1, pp. 7–12, 2 figs., 1 fldg. pl. Honolulu, 1932.

Extensive outbreaks of *Spodoptera mauritia*, Boisd., began in many parts of Hawaii in April and May 1931 and were still occurring in the following January in some localities. In many cases young plants of sugar-cane were entirely defoliated and in some instances eventually killed by the concentrated feeding of the older larvae of successive generations. Nutgrass, *Cyperus rotundus*, is very common in most of the cane fields, and laboratory tests showed it to be preferred by the newly hatched larvae to succulent cane leaves, on which few succeed in developing. It is improbable that outbreaks would occur in the absence of this weed. In fields of young cane the eggs are usually laid near the tips of the leaves, from which the larvae lower themselves on silken threads to feed on *C. rotundus* or grasses. After 7–10 days large numbers return to the cane, on which they remain for 7–10 days. Pupation occurs in the ground or beneath rubbish, etc., the pupal period lasting 1–2 weeks.

Control may be effected by dusts of 5 lb. white arsenic or 6 lb. lead arsenate to 30 lb. finely powdered raw rock-phosphate. Scorching of the cane leaves by white arsenic with this carrier is negligible, even if they are wet with dew or rain, and it is much cheaper than lead arsenate. Dusting should be done preferably while the larvae are still on the weeds and repeated, if necessary, at intervals of 2–3 weeks, or if rain occurs within 24 hours of application. As soon as the cane starts closing in and the weeds become less abundant, there is little danger of further damage. Recommendations for the preparation and application of the dusts are given.

SWEZEY (O. H.). **Some Observations on Forest Insects at the Nauhi Nursery and Vicinity on Hawaii.**—*Hawaii. Plant. Rec.*, xxxvi, no. 2, pp. 139–144. Honolulu, 1932.

An account is given of the results of a survey during September–October 1931, conducted to determine the insects associated with native trees.

LEONARD (M. D.). **Insect Conditions in Puerto Rico during the fiscal Year, July 1, 1930, thru June 30, 1931.**—*J. Dept. Agric. Puerto Rico*, xvi, no. 2, pp. 121–144. San Juan, P.R., April 1932. [Recd. November 1932.]

Very brief notes are given on a large number of insects observed in Porto Rico during the period 1st July 1930 to 30th June 1931, arranged under the plants attacked.

PINTO DA FONSECA (J.) & AUTUORI (M.). **Principaes pragas do café no Estado de São Paulo.** [The principal Pests of Coffee in the State of S. Paulo.]—87 pp., 40 figs. S. Paulo, Sec. Agric., Inst. biol. Def. agr. anim., 1932.

This is a compilation, for the benefit of coffee growers in São Paulo, of information on the appearance, bionomics and control of the principal insect, mollusc, and Nematode pests of coffee. The space allotted to each species varies with its importance, nearly half the work being devoted to the coffee berry borer, *Stephanoderes hampei*, Ferr.

WESTPHALEN (M.). **Um inseto util,** *Chrysopa lanata*, **Blanchard.** [A useful Insect, *C. lanata.*]—*Egatea*, xvii, no. 4–5, pp. 182–185, 2 figs. Porto Alegre, 1932.

Chrysopa lanata, Blanchard, has been found destroying Coccids infesting orange trees in Brazil. Descriptions of the adult and larva are given. The female lays about 60 eggs, usually on the lower surface of the leaves. The egg-stage occupies 12–18 days, the larval 25–30, and the pupal about 15 days in summer or several months in winter.

MONTE (O.). **As pragas das Aboboreiras.** [Pests of Curcubits.]—*Correio agric.*, x, no. 9, pp. 187–191. Bahia, September 1932.

The Pyralids, *Diaphania nitidalis*, Stoll, and *D. hyalinata*, L., and the Aegeriid, *Melittia satyriniformis*, Hb., attack curcubits in Bahia, Brazil, sometimes destroying the entire crop. The first two oviposit on the fruits, leaves and stems, and the larvae bore into the stems and

then attack the fruits, subsequently pupating in the ground. The larva of *Melittia* lives in the stem and also pupates in the ground. The measure advised against these moths is the removal and burning of infested parts. Other pests include the Galerucids, *Diabrotica speciosa*, Germ., and *D. bivittula*, Kirsch, the Coccinellids, *Epilachna cacica*, Guér., and *E. marginella*, F., *Aphis gossypii*, Glov., and the Coreid, *Leptoglossus gonagra*, F.

MUESEBECK (C. F. W.). **Two new Species of phytophagous Eurytomidae (Hymenoptera: Chalcidoidea).**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 7, pp. 109–112, 1 ref. Washington, D.C., October 1932.

Descriptions are given of both sexes of *Prodecatoma diospyri*, sp. n., bred from the fruits and seeds of *Diospyros ebenaster* in Mexico, and *Harmolita opuntiae*, sp. n., from *Opuntia spinosior* in Arizona.

DOZIER (H. L.). **The Identity of certain Whitefly Parasites of the Genus *Eretmocerus* Hald., with Descriptions of new Species (Hymenoptera: Aphelininae).**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 7, pp. 112–118, 1 fig., 2 refs. Washington, D.C., October 1932.

The new species are: *Eretmocerus illinoisensis*, described from males collected with adult Aleurodids over low weed and grass in Illinois; *E. portoricensis*, from females reared from *Aleurothrixus floccosus*, Mask., in Porto Rico, where it has been recorded as *E. californicus*, How. [*R.A.E.*, A, xiv, 301]; and *E. pallidus*, from females from an undescribed species of *Tetraleurodes* on *Anona squamosa* in Haiti. Redescriptions are given of both sexes of *E. corni*, Hald., bred from *Trialeurodes morrilli*, Britton, in Delaware, and of the female of *E. paulistus*, Hemp., from *A. floccosus* in Haiti. *E. corni* is the genotype; the original material had been lost and it had not subsequently been found. The other species of the genus are: *E. haldemani*, How., *E. australis*, Gir., *E. diversiciliatus*, Silv., *E. serius*, Silv., *E. orientalis*, Silv., and *E. mundus*, Mercet. All those that have been reared are parasites of Aleurodids.

DOZIER (H. L.). **Two undescribed Chalcid Parasites of the Woolly Whitefly, *Aleurothrixus floccosus* (Maskell), from Haiti.**—*Proc. Ent. Soc. Wash.*, xxxiv, no. 7, pp. 118–122, 2 refs. Washington, D.C., October 1932.

Descriptions are given of the female of the Aphelinid, *Encarsia haitiensis*, sp. n., and both sexes of the Eulophid, *Euderomphale aleurothrixi*, sp. n., and the Aphelinid, *Prospaltella brasiliensis*, Hempel, all from *Aleurothrixus floccosus*, Mask., in Haiti, the last also from an undescribed species of *Aleurothrixus*.

BAERG (W. J.), ISELY (D.) & SCHWARDT (H. H.). [Report on Entomological Work, 1931–32.]—*Bull. Arkansas Agric. Expt. Sta.*, no. 280, pp. 41–45. Fayetteville, Ark., October 1932.

The rough-headed corn stalk beetle [*Euetheola rugiceps*, Lec.] is widely distributed in Arkansas, in many parts of which it causes local damage. Breeding takes place in meadows and pastures in poorly drained hard-pan soil, this Dynastid being unable to thrive for any length of time in cultivated soil. Young maize planted in or near

infested grass land is often severely damaged by the beetles, and as many as three plantings may fail to produce a stand. Oviposition began on 30th June in 1931 and on 18th June in 1932, when it continued until 5th September. The eggs hatched in an average of 12 days, the larval stage lasted 51–104 days and the pupal 10–30 days. Larvae were reared with some success in a mixtue of heavy clay found where *Juncus* grows and a light sandy loam rather rich in humus [*cf. R.A.E.*, A, xx, 414]. Pupae and adults are commonly infested by the fungus *Beauveria* (*Botrytis*) *bassiana*, and mites attack both pupae and over-wintering adults. Preventive measures recommended are early planting and choice of land for maize that has not recently been under grass. Proper drainage and ploughing of grass land in late summer, when *E. rugiceps* is in the pupal stage, will reduce injury.

The strawberry weevil [*Anthonomus signatus*, Say] occurs throughout the State, causing damage varying in different seasons from slight injury to practical loss of the crop. The weevils appeared about 5th April in 1932. Calcium fluosilicate compound [*cf.* xiv, 273] was used without damage to the plants, and though its effectiveness could not be accurately estimated, as the infestation was relatively mild, it appeared to give control equal to that obtained with lead arsenate and hydrated lime, 1 : 2.

Life-history studies of the saw-toothed grain beetle [*Silvanus surinamensis*, L.], in which various forms of rice and rice products were fed to the larvae, have shown that rice polish produces beetles most rapidly, rice bran, brown rice, rough rice and polished rice being successively less favourable. No adults have been reared from larvae on whole polished rice. The beetles develop largely in rice polish, after which the adults invade all parts of the mills including the stored polished rice. In order to avoid infestation, polished rice should be stored in separate buildings at a distance from the mill, or if it must be stored in the mill, the latter should be kept free of open accumulations of rice by-products.

The information given concerning the rice water weevil [*Lissorhoptrus simplex*, Say] and the cotton boll weevil [*Anthonomus grandis*, Boh.] has already been noticed from other sources [xx, 414, 531].

Van Leeuwen (E. R.). **Reactions of the Japanese Beetle to Spray Deposits on Foliage.**—*Circ. U.S. Dept. Agric.*, no. 227, 18 pp., 4 refs. Washington, D.C., June 1932.

The following is almost entirely taken from the author's summary: The fact that fewer adults of the Japanese beetle [*Popillia japonica*, Newm.] accumulate on foliage sprayed with lead arsenate than on unsprayed foliage has led to the belief that this material is more repellent than toxic. The observations described show that an accumulation of beetles on a plant attracts other beetles flying in the vicinity. Many beetles are repelled before alighting on foliage sprayed with lead arsenate, those that alight being less numerous than those coming to similar but unsprayed plants. Most of the beetles leave foliage sprayed with lead arsenate or slaked lime within three hours; some fly away or drop off during the application of the spray. The percentage of beetles leaving foliage treated with lead arsenate is higher than that leaving unsprayed foliage during the same time.

The highest mortality of beetles that had eaten foliage sprayed with 3 lb. lead arsenate, 2 lb. wheat flour and 50 U.S. gals. water occurred

among those collected one hour after application, the range varying from 42 to 64·6 per cent. Some of the beetles present on the foliage during spraying operations consume a lethal dose, and sprays of lead or calcium arsenate are effective in killing the beetles over a period of several days. Acid and basic lead arsenate, lead arsenate coloured green, copper arsenate, magnesium arsenate, calcium arsenate, slaked lime, barytes, and china clay all proved repellent to the beetles. Chalk was repellent in three experiments and attractive in one. Paris green was slightly attractive in all cases. Many beetles coming to treated or untreated trees left without feeding.

Bodine (J. H.). **Hibernation and Diapause in certain Orthoptera. ii. Response to Temperature during Hibernation and Diapause.**—*Physiol. Zoöl.*, v, no. 4, pp. 538–548, 7 diag., 9 refs. Chicago, October 1932.

The following is the author's summary: Comparisons between certain physiological reactions of hibernation in nymphs of *Chortophaga viridifasciata*, DeG., and of diapause in eggs of *Melanoplus differentialis*, Thomas, have been presented. Hibernation in nymphs of *C. viridifasciata* is almost solely dependent on temperature. Responses of hibernating animals to different temperatures are of the same character as responses of non-hibernating animals. Rates of oxygen consumption and effects of temperature on same for hibernating and non-hibernating nymphs of *C. viridifasciata* are presented. Diapause in eggs of *M. differentialis* is, within limits, independent of temperature (above developmental zero) for its occurrence, but relatively dependent on temperatures (above developmental zero) for its duration. Low temperatures (10–0°C. [50–32°F.)] destroy the diapause factors in eggs of *M. differentialis*. Effects of temperature on rates of oxygen consumption of diapause eggs, as well as for eggs with no diapause, are presented.

Bodine (J. H.). **Hibernation and Diapause in certain Orthoptera. iii. Diapause—A Theory of its Mechanism.**—*Physiol. Zoöl.*, v, no. 4, pp. 549–554, 4 diag., 7 refs. Chicago, October 1932.

The following is the author's summary: In certain grasshoppers two types of eggs are produced—a non-diapause and a diapause type. Diapause eggs contain factors which cause diapause in rather definite fashion and at definite stages in the egg's development. Evidence is presented for considering action of diapause factors as of an "all or none type" of reaction. Diapause factors are extremely susceptible to low temperatures (below developmental zero) and can be completely destroyed or inhibited by appropriate exposure to these temperatures. A slow gradual destruction or loss of potency of the diapause factors occurs at constant high temperatures above developmental zero. An optimum temperature exists for certain species. For further analyses of diapause problems in such eggs, detailed studies on single eggs from controlled stock seem necessary.

Burkholder (C. L.). **Dusting vs. Spraying of Apples 1927–1931.**—*Bull. Purdue Univ. Agric. Expt. Sta.*, no. 356, 28 pp. Lafayette, Ind., December 1931. [Recd. November 1932.]

The results are recorded of investigations on the use of dusts and sprays in apple orchards in Indiana [*cf. R.A.E.*, A, xiii, 271] resumed

during a further five-year period 1927–31. Dusts and sprays composed of various forms of sulphur and lime-sulphur were used, with the addition of lead arsenate at the rate of ½–2 lb. to 50 U.S. gals. for the sprays and 15 per cent. for the dusts. Sprays, though applied less frequently than dusts, gave better control of the codling moth [*Cydia pomonella*, L.] during every year of the work, the five-year average showing 1·2 per cent. infested fruit and 7·9 per cent. "stings" for sprayed plots, as compared with 8·5 per cent. and 15·3 per cent. for those receiving colloidal dusts and 15–25 per cent. infested fruit on untreated trees. The inferiority of dusts was less marked in the case of two varieties of apple picked 3–4 weeks earlier than the others.

No significant differences in insect control were observed from the use of 2 per cent. oil in the lime and lead arsenate dust in July and August 1931. The dusting programme was more carefully carried out than would be possible in the average commercial orchard. Brief notes are given on the more recent results of dusting and spraying apples in other States.

Ford (O. W.) & Burkholder (C. L.). **Spray Residue and its Removal from Apples.**—*Bull. Purdue Univ. Agric. Expt. Sta.*, no. 345, 18 pp., 6 figs., 11 refs. Lafayette, Ind., February 1931. [Recd. November 1932.]

In view of the continuous reduction in tolerance of arsenic on fruit for interstate shipment in the United States, bringing it steadily in the direction of the world tolerance of ·01 grains per lb., analytical work has been carried out in Indiana in 1927 and 1930 with the object of determining the actual arsenical load of packed apples from a number of representative orchards in the State, and of studying the efficiency of various washing and cleaning methods in the removal of this residue and the possible injury resulting from them.

In this report on the work, an account is given of methods and costs of operation of both the dipping tank and the large commercial washer, and the spray schedules in force are discussed in relation to the spray residue results obtained. No acid injury of consequence was detected on fruit dipped for 4 minutes in 1 per cent. hydrochloric acid, but 2 per cent. and 4 per cent. acid (by volume) both caused very definite injury and the amount of injury increased with the strength of the acid used. Certain less susceptible varieties of apple showed no significant injury even from 4 per cent. solutions.

It would seem safe to conclude that in this region 1 per cent. acid by volume is a satisfactory strength for the removal of residue by the dipping method. In the flood type commercial washer 20–30 seconds exposure to 1 per cent. hydrochloric acid reduced the arsenical load below the world tolerance. The use of 2 per cent. and 4 per cent. acid in the dipping tank was not of sufficient added benefit to outweigh the question of injury. Salt alone, or in combination with any of the strengths of acid used, was not of material value in reducing the residue, and wipers or brushes were ineffective.

Cleveland (C. R.). **The Relation of Insects to the Transmission of Potato Leafroll and Tomato Mosaic in Indiana.**—*Bull. Purdue Univ. Agric. Expt. Sta.*, no. 351, 24 pp., 2 figs., 20 refs. Lafayette, Ind., April 1931. [Recd. November 1932.]

Field observations and transmission tests in cages carried out to determine the importance of insects as vectors of potato leaf-roll

showed that in Indiana *Myzus persicae*, Sulz., and *Empoasca fabae*, Harr., are mainly responsible, and that whereas *M. persicae* was generally prevalent and potentially most capable of transmitting the virus, it was somewhat less abundant and less constantly present than *E. fabae*. *Macrosiphum gei*, Koch (*solanifolii*, Ashm.), though it readily transmitted leaf-roll, is not sufficiently prevalent in Indiana to be a major factor in dissemination. Cage-tests indicate that *Epitrix cucumeris*, Harr., is of little or no significance in the spread of the disease, and experiments with *Thrips tabaci*, Lind., gave negative results. Other insects were not prevalent enough on potatoes to warrant consideration as possible factors of any importance in leaf-roll transmission.

The situation and associated insect prevalence of potato plantings considerably influences the spread of the disease. There is some evidence that a degree of attack, especially by leafhoppers, sufficiently severe to upset the normal physiological processes of the plant probably inhibits the transfer of the virus from leaf to tuber to a certain extent, thus actually reducing spread. An extremely heavy infestation by leafhoppers may thus result in less spread than a moderate one. Aphids, which produce less violent mechanical or toxic disturbances in the plant cells, do not appear to exhibit the same phenomenon.

Experiments in which a spray consisting of Bordeaux mixture, lead arsenate and nicotine sulphate (1 : 600) was applied, in some cases 3 times and in others 7, in July, August and September, showed that spraying distinctly reduces leaf-roll, and that the more complete protection from insects afforded by more extensive spraying gave the most effective results. Since spraying reduced *E. fabae* more distinctly than any other insect, it was concluded that this leafhopper is the chief vector.

A further investigation carried out to ascertain the insects prevalent on tomato and certain perennial weeds, particularly *Physalis*, which harbour the virus of tomato mosaic in Indiana [*R.A.E.*, A, x, 442], and to determine which transmit the disease showed that *M. persicae* is mainly responsible for transmission from tomato to tomato. It had a higher potential ability to transmit than any other species tested and was particularly abundant during the season when the spread of mosaic is most marked. It is probably, however, only to a minor degree responsible for transmission from wild host-plants. Although *E. fabae* appeared to be capable of transmitting tomato mosaic, its limited and sporadic occurrence on *Physalis* and tomato suggests that it is not responsible to any great extent. Controlled tests failed to show that *Macrosiphum gei* is a vector. *Thrips tabaci* appeared to be capable of transmitting mosaic to a limited degree, but is less abundant on the host plants and less active in migrating from plant to plant than *M. persicae*. *Tetranychus telarius*, L., seemed capable of transmission when transferred in large numbers from plant to plant, but it is doubtful whether such transfers take place naturally to a sufficient degree to render this mite important as a vector. *Trialeurodes* (*Aleurodes*) *vaporariorum*, Westw., did not appear to be capable of transmitting the disease. *Epitrix cucumeris* was the only chewing insect infesting both wild and cultivated hosts of tomato mosaic in sufficient abundance and regularity to suggest a relationship to transmission, but although capable of carrying mosaic to a limited degree, it cannot be considered of any appreciable importance. It is estimated that insects, principally

M. persicae, are responsible for at least 50 per cent. of the annual spread of mosaic through tomato plantings in Indiana.

From 4 to 5 applications of the spray used on potato against leaf-roll, made at approximate intervals of 10–14 days during the early part of the season, almost completely protected tomatos from attack by insects and reduced the spread of mosaic.

QUERCI (O.). **An account of my Studies in the Biology of *Pieris rapae*.**—*Ent. Rec.*, xliv, no. 12, pp. 168–176. London, December 1932.

A detailed account is given of the results of observations on the succession and characters of the broods of *Pieris rapae*, L., in Pennsylvania in 1932 and of experiments in breeding from the eggs and the effect of temperature on eggs, larvae and pupae. The author concludes that *P. rapae* and many other polygenetic species are ready to be prolific at any time of the year, as soon as the temperature allows their eggs to hatch. Cold is probably only injurious below 15°F.; otherwise it merely delays metamorphosis. Intense heat, above 90°F., causes a very high mortality among the larvae, but has no effect on the eggs or pupae. When the mean temperature is above 60°F., a new brood occurs about every 18 or 19 days. The duration of the flying period of every brood is at least 15 days longer than that of the preceding one, and therefore all the broods, except the first, overlap. In 1932 at Philadelphia, with a uniform and favourable season, but shorter than in most years, there were certainly eight broods and probably a ninth. When the adults emerge from April to October, there may be 10 or 11 broods. In southern Spain and Portugal, and in the southern part of the United States, 14 broods perhaps occur in most years.

FENTON (F. A.) & WAITE (W. W.). **Detecting Pink Bollworms in Cottonseeds by the X-Ray.**—*J. Agric. Res.*, xlv, no. 6, pp. 347–348, 1 pl. Washington, D.C., 15th September 1932.

By means of X-ray photographs it has been found possible to detect living and dead larvae of *Platyedra* (*Pectinophora*) *gossypiella*, Saund. (pink bollworm) in cotton seeds. Seed direct from the gin can be used with as good results as seed from which the lint has been removed, but unginned seed is rather less satisfactory as it occupies too much room on the film and the seeds are often superimposed so that it is impossible to obtain a clear picture of all of them. The seeds are best arranged touching in closely packed rows of one layer over the film. This operation is, however, too expensive for regular use.

FINK (D. E.). **The digestive Enzymes of the Colorado Potato Beetle and the Influence of Arsenicals on their Activity.**—*J. Agric. Res.*, xlv, no. 8, pp. 471–482, 18 refs. Washington, D.C., 15th October 1932.

The following is taken from the author's summary: It is clear from experiments here reported that arsenic does not influence the digestive enzymes of adults of *Leptinotarsa decemlineata*, Say, fed on sprayed foliage to the extent of inhibiting their normal activity. In general, when they are fed on foliage sprayed with an arsenical, there is but little retardation of the activity of amylase and tryptic enzymes, and none at all of enzymes active in the digestion of disaccharides and

fats. However, the injection of arsenical suspensions directly into the insect mouth results in complete inhibition of the activity of the proteolytic enzymes.

Enslin (E.). **Die Bewohner der Brombeerstengel.** [The Inhabitants of Blackberry Stems.]—*Ent. Jahrb.*, xlii (1933), pp. 134–148. Leipzig [1932].

This is an account of insects, predominantly Hymenoptera and including hibernating sawfly larvae, found in Germany in dead stems of blackberry in winter, and their parasites.

Butovitsch (V.). **Das Flugvermögen des grossen braunen Rüsselkäfers.** [The Flight Capacity of *Hylobius abietis*.]—*Forstw. Zbl.*, li, no. 13, pp. 446–460. Berlin, 1st July 1932.

The following is taken from the author's summary of the results of observations on the flight of *Hylobius abietis*, L., in Germany in 1930 and 1931.

The weevil does not fly until 1–2 weeks after issuing from hibernation ; it usually leaves its winter quarters in April in northern and eastern Germany. About 1–3 weeks after the first flight, mass flights take place, but if the weather is unfavourable they do not occur at all. They are usually at their height in May, and flight ceases in midsummer. The weevils fly quickly and have been observed to cover distances of over 530 yards and to attain a height of over 150 ft. They tend to fly in the direction of the wind or in calm weather towards the area felled in the preceding year. Newly felled trees, wood-stacks and saw-mills are highly attractive and, with a favourable wind, cause mass flights. When leaving the ground, the weevils only rise very gradually. They fly readily in sunny, calm weather, especially in the early afternoon. Flight capacity is independent of sex and is first present in young individuals that have hibernated.

Trap-trenches must be dug early so as to catch the weevils before they are on the wing. They should be dug quite close to the edges of the stands surrounding the area to be protected to ensure the advantages of shade, and on the northern edge of the area they are best dug a few yards inside the stands. In this way the weevils will reach the trenches before taking wing. It is not possible to avoid the flight of weevils to the year's felled areas, especially if they are extensive, but the danger is much decreased by carting away the felled timber before the beginning of the flight period. In trap-trenches the width of the pits containing twigs dusted with calcium arsenate [*R.A.E.*, A, xix, 663] should be reduced to about 18 ins., to prevent the insects from flying out of the trench. For the same reason the layer of twigs should only be one-third the depth of the pit. Isolation trenches dug early in July round an area felled in the previous year are of great value against the newly emerged adults, which wander over the ground to neighbouring stands in which they hibernate [see next abstract].

Butovitsch (V.). **Neue Wege zur Bekämpfung des grossen braunen Rüsselkäfers.** [New Methods for the Control of *Hylobius abietis*.]—*Forstarchiv*, 1931, no. 23, reprint 7 pp. Hanover, 1931. [Recd. November 1932.]

The information given here on the flight of *Hylobius abietis*, L., and methods of control is similar to that already noticed [see preceding

paper and *R.A.E.*, A, xix, 662]. As an alternative to an arsenical, paradichlorobenzene has been successfully used in pits in trap-trenches. Such trenches are not suitable for hilly country or areas with stony or clay soil, in which the only practical measure is the use of billets, bark, and stumps as traps. The previously unknown winter quarters of the weevil were ascertained to be in stands, especially those of pole wood, only 2 per cent. of the young adults hibernating where they have matured.

DE VIN (T. J.). **Vruchtboomcarbolineum.** [Fruit-tree Carbolineum.] —*Tijdschr. Plantenziekt.*, xxxviii, no. 10, pp. 220–227. Wageningen, 1932.

Records are given of the increased use that is being made of tar distillates as dormant sprays for fruit trees in South Gelderland, Holland. For the most effective results, especially against the winter moth [*Cheimatobia brumata*, L.] they should not be applied to trees that are wet. Plums are very susceptible to injury by tar distillates, but no case of damage was reported where a 7½ per cent. spray was used before February.

GRIMALDI (A.). **Un nuovo aficida.** [A new Insecticide for Aphids.]—*Ital. vin. agrar.*, 1932, no. 42, separate 4 pp. Casale Monferrato, 16th October 1932.

Tests of various substances, made to find an insecticide as efficient against Aphids as nicotine but less expensive, have resulted in the discovery of a preparation containing products of fatty acids and entirely free from the principles found in nicotine, quassia, pyrethrum, etc. It is highly toxic to *Hyalopterus arundinis*, F. (*pruni*, F.) and *Anuraphis amygdali*, Buckt. (*persicae*, Boy.).

DELASSUS (—) & PASQUIER (R.). **Lutte et mesures de protection prises, en Algérie, contre les parasites et maladies des cultures.**—*Bull. écon. Off. algér. Action écon. tourist.*, i, no. 1, pp. 62–71. Algiers, October 1932.

An account is given of the activities of the Government Plant Protection Service in Algeria, which include insect control, the enforcement of plant quarantines and research, and brief reference is made to the work of the local Defence Syndicates.

GURNEY (W. B.). **Brown Vegetable Weevil now attacking Tomatoes and Potatoes.**—*Agric. Gaz. N.S.W.*, xliii, pt. 10, p. 782. Sydney, October 1932.

Infestation of early tomato and potato crops by the adults of *Listroderes obliquus*, Gyll., is recorded from New South Wales, and brief notes are given on its bionomics. The weevils are readily controlled by spraying with lead arsenate (1 lb. powder, or 1½ lb. paste, to 16 gals. water), or by dusting with lead arsenate and lime or kaolin (1 : 3). The dust is the more effective and takes only about a third of the time to apply. The same insecticides may be used against the larvae, which attack carrots, turnips and beets in autumn and winter. If a crop has to be replanted in autumn owing to the damage

they cause, further injury may be prevented by cleaning up the ground thoroughly, and 2–3 days later scattering over it a bait made by chopping up a preferred food-plant, such as cape weed [*Cryptostemma calendulaceum*], that has been treated with lead arsenate. The larvae, and even the adults, readily feed on this bait if it is distributed late in the afternoon so that it remains fresh overnight.

SMITH (J. H.). **Pin-hole Borers of the Walnut Bean** (*Endiandra palmerstoni*).—*Queensland Agric. J.*, xxxviii, pt. 3, pp. 229–246, 6 figs. Brisbane, 1st September 1932.

The walnut bean (*Endiandra palmerstoni*) has recently become of importance in Queensland as a source of wood for veneer, but its export value is often lowered owing to defects in the heartwood caused by insects. Investigations on those associated with the logs after felling were therefore begun in the summer of 1930–31. Logs cut off the same tree in December were left on the ground or raised slightly on skids in the scrub and in the open, one in each situation being treated in January by exposing part of the heartwood to direct lateral infestation and by removing strips of bark to determine its influence on the fauna.

Shot-hole borers were the first to penetrate the bark. Pin-hole borers were unable to complete their tunnels in the bark, but the Platypids, *Crossotarsus* sp. and *C. grevilleae*, Lea, gained entry through the exposed surface of the heartwood and sapwood at the end of the log. In about 5 weeks, however, the resistant properties of the bark had diminished sufficiently to allow *Xyleborus hirsutus*, Lea, to penetrate directly through it. During the period of exposure in the scrub, the weevil, *Dysopirrhinus grandis*, Lea, bored in the bark, but it is apparently of no economic significance.

X. hirsutus, which has two or more generations a year, burrows for some time on the surface of the sapwood before entering it. It does not attack the heartwood under normal conditions. *C. grevilleae* is the most serious pest and is common during the wet season, few, if any, logs escaping injury. Infestation takes place at any point where the wood is unprotected by the bark, occurring first at the cut surface of the log and subsequently through cracks, abrasions, etc. The entrance tunnel is cut at an acute angle to the surface, and preference is shown for the sapwood, though, under suitable conditions such as are common in the interior of the rain forests, the heartwood may be riddled throughout the length of the log. There does not appear to be more than one generation a year. A number of fungi were taken from the tunnels of the borers.

The relation of the incidence of the borers to logging practices is discussed, and it is considered that where possible logging should be carried out during the winter and that if it has to be done in summer, only trees believed to be sound should be cut, while those damaged in the process should be disposed of locally. All logs should be removed from the scrub as soon as they are felled and placed in the open. The bark should be left intact, as it is a protection against infestation, and the ends of logs should be covered with some substance repellent to *C. grevilleae*.

Various specifications by which inspectors may determine the quality of the logs for export are suggested.

RAMAKRISHNA AYYAR (T. V.). **Bionomics of some Thrips injurious to cultivated Plants in South India.**—*Agric. Live-stk. Ind.*, ii, pt. 4, pp. 391–403, 4 pls., 1 fig., 24 refs. Calcutta, July 1932.

Brief notes are given on the economic importance, food-plants and distribution of ten injurious species of thrips occurring in southern India. Eight of these have been noticed in a previous paper [*R.A.E.*, A, xvii, 504], the two additional species being *Bregmatothrips ramakrishnae*, Bagn., on the tips of sugar-cane leaves, and *Panchaetothrips indicus*, Bagn., causing slight damage to turmeric and arrowroot. *Thrips tabaci*, Lind., has been found to be a major pest of onion and garlic, and *Selenothrips rubrocinctus*, Giard, to cause serious injury to cashew (*Anacardium occidentale*).

GEORGI (C. D. V.) & TEIK (GUNN LAY). **The Rotenone Content of Malayan Tuba Root.**—*Malayan Agric. J.*, xx, no. 10, pp. 498–507, 11 refs. Kuala Lumpur, October 1932.

The following is taken from the authors' summary: Analyses of samples of derris root from commercial consignments show wide variations in rotenone content. From the analyses of roots from individual species, it appears that variations are due to commercial consignments frequently consisting of roots from different species of *Derris* and also of varying age, and that *D. elliptica* (tuba puteh) offers the best possibilities as a source of rotenone. The optimum conditions of cultivation and harvesting have yet to be determined. The roots of the other variety of *Derris* commonly occurring in Malaya, *D. malaccensis* (erect Sarawak), would appear to be lacking in rotenone. The results of analysis of the roots of different species for rotenone content are not to be considered as indicative of their relative toxicities. The latter can only be determined as a result of controlled tests on different classes of insects.

CORBETT (G. H.) & YUSOPE (M.). **The Coffee Clear Wing Hawk Moth (*Cephonodes hylas* L.).**—*Malayan Agric. J.*, xx, no. 10, pp. 508–517, 1 pl., 8 refs. Kuala Lumpur, October 1932.

The Sphingid, *Cephonodes hylas*, L., occasionally causes severe injury to coffee in Malaya and also attacks *Gardenia*. All stages are described, with notes on its distribution and economic importance. A serious outbreak occurred on coffee over an area of 1,500 acres in mid-December 1928. Most of the bushes were completely defoliated, many of them subsequently showing die-back, and in some cases the berries and bark were also attacked. Another outbreak in a different locality at the end of 1929 resulted in the death of 5 per cent. of the bushes, and crop production only became normal after a period of 18 months.

Although *C. hylas* has been observed both on coffee and *Gardenia* all the year round, no reports of extensive injury have been received during May-October, the drier months. Six or seven generations may be produced during October-May. Laboratory observations showed that the eggs are laid singly on the lower surface of the youngest leaves, the maximum number deposited by one female being 17, although dissections of gravid females indicated that in the field the number laid is probably much greater. The egg, larval and pupal stages averaged 3, 21 and 13 days respectively.

Lack of food is undoubtedly the chief factor responsible for the termination of an infestation, although diseases and the Encyrtid egg-parasite, *Ooencyrtus malayensis*, Ferrière [*R.A.E.*, A, xix, 538], the life-history of which is briefly discussed, are also of importance. Of 240 eggs of *C. hylas* collected on 26th January 1929, 102 were infested by this parasite. The Reduviid, *Sycanus leucomesus*, Wlk., preys on the larvae and adults, but has little controlling influence, and the Ceratopogonid, *Forcipomyia hirtipes*, de Meij., has been observed sucking a larva, without, however, causing any permanent injury to it. Constant examination of the coffee bushes and hand-collection of the larvae are recommended during June-August, the period when the infestation is incipient. If the larvae are present in numbers, spraying with 2 lb. lead arsenate to 50 gals. water or, if this is not available, with the extract from 2 lb. derris root in 10 gals. water should also be carried out.

DU PASQUIER (R.). **Principales maladies parasitaires du théier et du caféier en Extrême-Orient.**—*Bull. écon. Indochine*, xxxv, pp. 367B–415B, 19 figs., 6 pls., 81 refs. Hanoi, 1932.

This paper, the second of a series [*cf. R.A.E.*, A, xx, 718], deals with the Lepidoptera, including a very large number of species, and contains coloured illustrations of all stages of the following :—the Notodontid, *Andraca bipunctata*, Wlk., which is one of the chief pests of tea in Formosa, and sometimes causes severe damage to it in India, Indo-China and the Netherlands Indies ; the Zygaenid, *Heterusia aedea*, L., f. *magnifica*, Butl., which is occasionally a serious pest of tea in India, but is of minor importance in Indo-China ; the Cossid, *Zeuzera coffeae*, Nietn., which sometimes causes serious damage to coffee and also attacks tea and which occurs in India, Ceylon, the Netherlands Indies, Japan and Indo-China ; the Limacodids, *Parasa* sp. (? *lepida*, Cram.), on tea in Sumatra, and *Chalcocelis albiguttata*, Snell., on coffee in Java and Indo-China ; the Lymantriid, *Nygmia bipunctapex*, Hmps., on tea in Indo-China ; *Indarbela* (*Arbela*) *dea*, Swinh., common on tea in Indo-China ; the Tortricids, *Homona coffearia*, Nietn., which sometimes occurs on coffee in Ceylon and Java and is an important pest of tea in Ceylon, Formosa, Japan, and to a less extent in India, Indo-China and Java, *Adoxophyes privatana*, Wlk., on tea in Formosa and Indo-China, and *Tortrix* (*Cacoecia*) *micaceana*, Wlk., on tea and coffee in Indo-China, India and Java ; and two Tineids that attack tea in Indo-China. One plate shows the cases of the following Psychids :—*Clania crameri*, Westw., which is common on tea in Japan, Formosa, Java, India, and to a less extent Indo-China ; *C. variegata*, Snell., which causes serious damage to coffee in Java and to tea in India ; *Cryptothelia* (*Pagodia*) *hekmeyeri*, Heyl., a minor pest of tea in Java and Indo-China ; and *Amatissa consorta*, Templ., outbreaks of which sometimes occur on tea in India.

COMMUN (R.). **Rapport sur le fonctionnement de la division de phytopathologie pendant l'année 1931. I. Laboratoire d'entomologie.**—*Bull. écon. Indochine*, xxxv, pp. 447B–474B, 9 refs. Hanoi, 1932.

As a result of studies during 1931 in Indo-China notes are given on the bionomics and control of a number of insect pests arranged under the crops they attack. Owing to drought, an unusual outbreak

of locusts occurred in Annam on rice in September, severe damage being caused in some localities; it was recommended to plough all fallow land adjoining infested rice fields to a depth of 6 ins. in October to destroy the egg pods or expose them to birds, etc. Other pests recorded on rice included *Delphacodes* (*Liburnia*) sp. in Cochin China; the Pentatomid, *Tetroda histeroides*, F., in Cambodia; *Heteronychus* sp. in Annam; and the Noctuid, *Cirphis* sp., and the Satyrid, *Melanitis leda*, L., the larvae, pupae and adults of which are described. Stored rice was severely infested by *Calandra oryzae*, L., and *Sitotroga cerealella*, Ol.

Kapok was attacked by the weevils, *Astycus lateralis*, F., which also occurred on coffee and tea, *Alcides scenicus*, Fst., *A. frenatus*, Fst., and *Desmidophorus* sp., and living trees of *Hevea* in Cochin China were considerably damaged by termites. Other pests included the Pentatomid, *Rhynchocoris* sp., and *Papilio demoleus*, L., on *Citrus* in Cochin China; the Hesperiid, *Erionota thrax*, L., on banana; the Tingid, *Diplogomphus capusi*, Horv., damaging the inflorescences of pepper [*Piper*]; the Pyralid, *Marasmia* sp., on the leaves of soy-beans; and the Pierid, *Catopsilia crocale* f. *alcmene*, Cram., which defoliated *Cassia siamea* grown as shade for tea.

SUBRAMANIAN (T. V.). **Annual Report of the Entomological Section for 1930–31.**—*Rep. Mysore Agric. Dept. 1930–31*, pp. 28–32. [Bangalore] 1932.

Information contained in this report in regard to the doubtful occurrence of *Stephanoderes hampei*, Ferr., on coffee in India, and the mass rearing of *Trichogramma* has already been noticed [*R.A.E.*, A, xix, 716; xx, 153]. *Orthezia insignis*, Dougl., has been spreading on *Lantana* in Bangalore, where it constitutes a potential pest of crops and has been detected on 30 ornamental plants. The practice of fostering this Coccid in the hope of eradicating *Lantana* is therefore to be discouraged. Severe injury has been caused to coffee by an unidentified grasshopper, which is spreading rapidly in one locality, the leaves being eaten and the bark destroyed in patches. The egg masses were always laid attached to underground parts of the stems of young coffee and shade trees at a depth of about 1 inch.

Experiments in the control of *Epilachna vigintioctopunctata*, F., on potato showed that a dust of 1 lb. sodium fluosilicate in 8 lb. lime will kill 50–60 per cent. in 2–3 days. Road dust did not prove satisfactory as a carrier. A water extract of powdered bark of *Mundulea suberosa* (1 oz. to 1 pint) with soap secured 100 per cent. mortality in the laboratory. In the field this powder gave 70 per cent. mortality when applied as a dust and was found to be effective as a spray when used on a small scale at the rate of 1 lb. to 8 gals. water with soap.

Tests with tar distillates against *Xylotrechus quadripes*, Chevr., showed that eggs were laid only after about 11–12 days on coffee stems washed with a 20 per cent. solution, and after a week on those treated with a 10 per cent. solution, rain having in each case weakened the effect. In both cases eggs were not laid in the usual places, but were exposed in situations where the larvae dropped off after hatching. A 20 per cent. wash killed all eggs and larvae except those that had entered into the green living tissues, or 75 per cent.; at 5 and 10 per cent. strength the kill was much lower. As the result of an application of 10 per cent. tar distillate during the middle of the flight season,

plants that had to be pulled up on account of attack by *X. quadripes* amounted to only one-third the number of those destroyed in an untreated area. The application of a 20 per cent. solution was less satisfactory, and the number of plants pulled up in an area where the plant stems were plastered over with termite earth and mucilage was found to be a little more than that in the untreated area.

NEWMAN (L. J.). **Web-worm** (*Sclerobia tritialis*).—*J. Dept. Agric. W. Aust.*, (2) ix, no. 3, pp. 431–434, 3 figs. Perth, W. A., September 1932.

Throughout the winter of 1932, outbreaks of the Pyralid, *Sclerobia tritialis*, Wlk. [*cf. R.A.E.*, A, xv, 639], occurred in Western Australia on weedy stubble or grass land turned in late. The adults and eggs are briefly described. The moths appear after the first autumn rains and are attracted for oviposition to grass or stubble, never occurring on clean fallow. The eggs, or young larvae, are turned in when the land is ploughed for sowing wheat, but this does not kill them, and the larvae are able to attack the young wheat as soon as it begins to grow. Serious loss is caused only if they are numerous. As one stool is demolished, they move on to the next. Since the wheat plants are eaten down below the crown, very little second growth occurs after the attack. Pupation takes place in the silken tubes in which the larvae live.

Preventive measures recommended include the avoidance of sowing wheat except on fallow land that has been kept free from rubbish and weeds, or, if this cannot be done, burning the stubble before the moths are attracted to it. The crops should be examined at regular intervals for the presence of the larvae, and if infestation occurs in patches, trenches or ditches with the edges as sharp as possible should be ploughed round them to prevent its spread. A poison bait of 30 lb. bran, 1 lb. Paris green and 4 lb. molasses has been found very effective. It should be broadcast thinly in late afternoon.

PESCOTT (R. T. M.). **The Cherry Borer Moth. A Serious Pest to Street Trees.**—*J. Dept. Agric. Victoria*, xxx, pt. 10, pp. 487–488, 495, 5 figs., 5 refs. Melbourne, October 1932.

Maroga unipunctana, Don. (cherry borer moth) causes serious injury to elms (*Ulmus campestris*), the oriental plane (*Platanus orientalis*) and willows (*Salix babylonica*), grown for ornamental purposes in the streets of towns in Victoria, where it has also been recorded as a pest of cherry, peach and plum. Up to 40 eggs are laid on the bark, and they hatch in a few days. The native food-plants of this Tineid are the black wattle (*Acacia decurrens*) and the coastal honeysuckle (*Banksia integrifolia*), and the larvae tunnel in the fork between two branches of the old trees and in the upright limbs of the young ones. On fruit trees, however, they bore for some time under the bark, finally making their way through to the heart of the tree. On shade trees they tunnel on the surface under a protective covering of felted silk and sawdust excrement and subsequently penetrate to the heartwood, with the result that the whole area becomes damaged and the trees die. The entrances to the tunnels are usually covered with a web. The primary surface tunnelling may cause severe deformation or the death of a young tree. The pupal period

lasts several weeks and is passed in the tunnel, the top of which is often plugged with a wad of silken web and chewed wood. The adults usually emerge in the evening, when they may be found flying to lights. During the day they hide under the loose bark of the tree.

Trees severely attacked or individual infested limbs on otherwise healthy trees should be removed and burnt. In the initial stages of infestation the larvae can be killed by squirting into the tunnels a few drops of kerosene or carbon bisulphide and then plugging them with clay or grafting wax.

Cottier (W.). **Insect Transmission of Dry-rot** (*Phoma lingam*) **of Swedes.**—*N. Z. J. Agric.*, xlv, no. 4, pp. 219–224, 2 figs., 3 refs. Wellington, N.Z., 20th October 1932.

An account is given of further experiments in New Zealand on the transmission of dry rot (*Phoma lingam*) of swedes by a Staphylinid and a Drosophilid [*cf.* *R.A.E.*, A, xix, 81], which have now been identified as *Atheta pseudocoriaria*, Bernh., and *Drosophila rubrostriata*, Beck. Box cages were used in the experiments, an infected swede being planted in the centre of each box and four healthy ones round it. The precautions taken to prevent the spread of the spores in any way except by the agency of the insects are described. The results show that the disease was carried from the diseased swedes to the healthy ones by the insects introduced into the boxes, and was transmitted much more freely to those that had been damaged. *D. rubrostriata*, owing probably to its greater activity, infected a larger number of swedes than *A. pseudocoriaria*. Although these two insects would appear to be the most important vectors of the disease, it seems possible that any of the other members of the typical insect fauna of diseased swedes would prove capable of transmission to a varying degree according to their habits.

[Zakharov (L. Z.).] **Захаров (Л. З.). The Locust Problem in the Northern Caucasus. (The present Status and future Prospects.)** [*In Russian.*]—*Bull. N. Caucas. Inst. Plant Prot.*, i(viii), no. 1, pp. 3–13, 5 refs. Rostov-on-Don, 1932.

Of the three locusts of economic importance in the Northern Caucasus, *viz.*, *Dociostaurus maroccanus*, Thunb., *Calliptamus italicus*, L., and *Locusta migratoria*, L., the last named occurs in several breeding places situated in the reed-beds of the rivers Kuban, Kuma, Manuich and Terek. The Terek breeding area is the least known, and the author stresses the necessity of a thorough ecological survey of that region in order to determine the exact situations of the breeding grounds. Further ecological studies in other breeding areas and greater precision and scientific supervision in control work, in particular in reconnaissance, are also stated to be necessary.

The ecological requirements of *D. maroccanus* and *C. italicus* are rather similar. *D. maroccanus* has two definite permanent breeding areas, in the Stavropol district and in the reclaimed reed beds of the Kuban used for grazing cattle. In the latter both it and *C. italicus* have become established since the reclamation, and mass breeding takes place. *C. italicus*, which has always been present in the country, has lately become a serious pest, its numbers assuming most alarming proportions in 1930. It also occurs permanently in

semi-desert grazing lands. For control the author recommends agricultural measures, such as the ploughing of all fallow fields and strips of waste ground between cultivated fields, which are used by *C. italicus* for egg-laying, and the afforestation of river valleys and ravines.

[SKALOV (Yu. Yu.).] **Скалов (Ю. Ю.). Poisoned Baits as a Method of controlling the Migratory Locust** (*Locusta migratoria*, **L.**)**, under the Conditions of Kuban Habitats.** [*In Russian.*]—*Bull. N. Caucas. Inst. Plant Prot.*, i(viii), no. 1, pp. 14–36, 19 refs. Rostov-on-Don, 1932.

The following are the chief conclusions drawn from a series of experiments with poison baits against *Locusta migratoria*, L. Amongst hoppers of the first stage, baits cause up to 70 per cent. mortality only when vegetation is sparse, but from the second stage onwards their effectiveness increases greatly. Adult locusts also take baits readily, particularly if the vegetation is dried up. Bran is the most attractive carrier, and molasses increases its attractiveness. About 80 lb. of bait is required per acre if the vegetation is not too dense, the amount of sodium arsenite being about 2 oz. to 1 gal. water in the case of the three earlier hopper stages, and about 4 oz. for the subsequent stages. The hardness or otherwise of the water is of no importance ; even if it is definitely alkaline or contains ammonia, it does not affect the attractiveness of the bait.

[NEFEDOV (N. I.).] **Нефедов (Н. И.). On the Degree of the Infestation of the Soils of the Troitzk Steppe-Forest Reserve with the Egg-pods of** *Arcyptera microptera*, **F. W.** [*In Russian.*]—*Bull. Inst. Rech. biol. Perm*, viii, no. 1, pp. 1–17, 16 refs. Perm, 1931. (With a Summary in English.)

The distribution of the egg-pods of *Arcyptera microptera*, F. W., in relation to the soil and the density and composition of vegetation was studied by exact statistical methods, and it was found that they were most abundant in alkaline soils and least common in those rich in humus. On alkaline soils the most severely infested plots were those with a sparse vegetation, in particular plant associations of *Atropis tenuiflora* and *Elymus salsugenosus*.

[GAL'PERSHTEIN (Ya. M.) & MORITZ (L. D.).] **Гальперштейн (Я. М.) и Мориц (Л. Д.). Control of** *Schistocerca* **in Turkmenistan, S.S.R. (Report on Work done for the Control of the Migratory Locust).** [*In Russian.*]—*Ser. nauch. Nauchno-issled. Inst. Khlopkovod. i khlop. Promuish.*, pt. 7, 23 pp., 14 figs., 1 map. Tashkent, 1930. Price 65 *kop.*

Outbreaks of *Schistocerca gregaria*, Forsk., occurred in the Khorossan Province of Persia in 1927 and 1928 [*cf. R.A.E.*, A, xvii, 261], and in May 1929 huge swarms suddenly appeared in Turkmenistan from Persia and Afghanistan, the northern part of which was also seriously infested. During May and June the locust spread throughout the country and oviposited in fallow cultivated plots, waste places, cotton fields and sand-hills, over 1,440 sq. miles being infested. Hatching

began in late May and continued through June and July, the first adults of the second generation, which mainly migrated in a southerly direction, appearing in Merv on 26th June.

An account is given of the organisation of an extensive campaign for control, in which chemical methods, chiefly poison baits, were used over some 400 sq. miles and other measures in an area almost three times as large.

COLENO (P.). **Contribution à l'étude des acridiens migrateurs du Soudan.**—*Bull. Com. Etudes hist. sci. Afr. occid. franç.*, xiv, no. 3, pp. 218–292, 2 pls., 17 figs., 7 maps. Paris, 1931. [Recd. December 1932.]

Since the French occupation, great invasions of locusts occurred in the French Sudan in 1897–1902, 1906–09 and 1914–19 ; in no case is the species concerned definitely known, but in the last it was probably *Schistocerca gregaria*, Forsk. The present invasion began in 1928, when *S. gregaria* and *Locusta migratoria migratorioides*, Rch. & Frm., made their appearance practically simultaneously. Particulars are given of the migrations and breeding of these two species in the years 1928, 1929, 1930, and 1931, and the adults and hoppers are described.

From the available records it appears that *S. gregaria* enters the French Sudan from the north, north-east and east. Only one generation is produced there, in September–October, the swarms of which fly northwards in December, January and February.

In West Africa *L. m. migratorioides* apparently has two generations a year. Hatching begins in March–April in Guinea and during May, June and July gradually spreads northwards to the centre of the French Sudan. Swarms of adults of this generation fly and feed all over the latter area until September, when oviposition begins, and as the season advances it gradually spreads southwards. Large bands of hoppers are to be seen in Segou and Koutiala in October–November, and the adults arising from these fly southwards, where they lay eggs that hatch in the following spring. In Guinea swarms are most numerous in January–March, when none is to be seen in the French Sudan. No invading swarms of *L. m. migratorioides* were reported in the French Sudan prior to June 1928, when adults of ph. *transiens* were found at Diafarabé. At the beginning of July numerous bands of hoppers appeared in Diafarabé, San and Mopti, and the resulting swarms consisted of typical ph. *gregaria*. It appears, therefore, that the outbreak originated in the vast flood plain of the Niger, stretching from Macina to Niafunké [*cf. R.A.E.*, A, xix, 710] ; a description of this region is given, with particulars of precipitation and flood-levels during the last few years.

L. m. migratorioides generally attacks only graminaceous plants, though other plants are occasionally damaged [*loc. cit.*]. The hoppers are destroyed by various birds, and snakes, jackals, cats and dogs feed on the adults. The latter are also infested by the larvae of an unidentified Dipterous parasite, Nematodes, red mites, and a bacillus closely resembling *Coccobacillus acridiorum*.

Anacridium moestum, Serv., the adult of which is described, is always present in the French Sudan and occasionally forms considerable swarms.

The organisation of the services of locust intelligence and control in the French Sudan is described, and the usual control measures

are discussed. Poisoned baits are specially recommended. Since bran was practically unobtainable, baits were prepared of equal parts of sawdust or ground husks of ground-nuts and dried cow-dung, 100 lb. being mixed with 4 lb. sodium arsenate and 8 lb. molasses. In experiments 2 lb. 90 per cent. sodium fluosilicate proved to be about as toxic in baits as 4lb. sodium arsenate, and as the fluosilicate is cheaper and does not form lumps so readily, it was decided to use it exclusively in the 1932 campaign. For broadcasting the bait, the quantities required per acre are : on ground overgrown by tall grasses, about 56 lb. for 2nd and 3rd stage hoppers, and about 66 lb. for 4th and 5th stage ones ; and on bare ground about 42 lb. for 2nd and 3rd and about 49 lb. for 4th and 5th stage hoppers. When dealing with a moving column of hoppers, the bait should be spread in front of it in parallel strips about 22 yards apart.

JAMES (H. C.). **Coffee Mealy Bug Research.**—*Bull. Dept. Agric. Kenya*, no. 18 of 1932, 18 pp. Nairobi, 1932. Price 50 *cts.*

Of the mealybugs attacking *Coffea arabica* in Kenya, certain species occurring on the aerial parts of the plant are distinguishable from each other only with difficulty. The fact that the scarcely discernible differences between *Pseudococcus lilacinus*, Ckll., which is the commonest species [*R.A.E.*, A, xvi, 308], and *P. citri*, Risso, are of specific value is supported by biological evidence. For instance, the egg stages of these species average about 2 [*cf.* xx, 669] and 10 days, respectively, under the same conditions. A mealybug morphologically indistinguishable from *P. citri* attacks the roots of *C. arabica* in many parts of East Africa, often in association with a fungus. It is unable to live on the aerial parts of the plant, and it is therefore considered to be a distinct biological race. The fact that its eggs hatch in 10 days is of interest. The foliage-infesting form of *P. citri*, despite its wide distribution, is of minor importance, for it develops more slowly than *P. lilacinus* and is often heavily infested by internal parasites, which appear to be specific to it. Another mealybug, doubtfully identified as *P. comstocki*, Kuw., several years ago, though closely resembling *P. lilacinus* and *P. citri*, is readily distinguishable under the microscope, and comparison of it with *P. comstocki* from China has proved that this species has not yet been recorded from East Africa [*cf.* xvi, 307 ; xix, 230]. *P. lilacinus* has now been recorded on over 80 food-plants in Kenya [*cf.* xx, 669], a list of which is given.

A proprietary bituminous paint has proved of value in the application of grease bands for the control of *Pheidole punctulata*, Mayr, and a subspecies of *Acantholepis capensis*, Mayr, the most important of the ants that foster mealybugs, the paint preventing the absorption of the grease by the bark. As the result of observations and experiments, the author does not consider Psocids, particularly *Ectopsocus briggsi*, Mcl., to be of any great importance in the control of *P. lilacinus*, and the value of driver ants, particularly *Dorylus nigricans* var. *molestum*, Gerst., is doubtful. Examination of a number of mealybugs principally from *Coffea arabica* and *C. robusta* in Uganda did not reveal the presence of *P. lilacinus*, though several species similar to it were present, indicating that if this species occurs in that Colony it is rare, at any rate on coffee. The possibility of controlling it in Kenya by the introduction of beneficial insects is discussed,

and reference is made to the unsuccessful introduction of *Cryptolaemus montrouzieri*, Muls., from South Africa and of the Lycaenid, *Spalgis lemolea*, Druce, from Uganda.

The situation as regards the occurrence of the Capsid, *Lygus* [*simonyi*, Reut.], in association with *P. lilacinus* on coffee is briefly discussed. Frequent counts of the Capsids should be made, especially in areas where it is necessary to apply annual control measures against mealybugs, and if they are numerous, the immature forms should be shaken from the tree on to a sheet of calico and destroyed.

Le Pelley (R. H.). **Coffee Capsid Bug** (*Lygus simonyi*, **Reut.**) **and the Use of Kerosene Extracts of Pyrethrum for the Control of** *Lygus* **and** *Antestia*.—*Bull. Dept. Agric. Kenya*, no. 22 of 1932, 18 pp., 12 refs. Nairobi, 1932. Price 25 *cts*.

The first part of this paper deals with *Lygus simonyi*, Reut., and the damage it causes to coffee in Kenya [*R.A.E.*, A, xx, 117, 337], and the second with the use of a kerosene extract of pyrethrum as a spray against *Lygus* and *Antestia* [xix, 645; xx, 500]. Experiments against *Lygus* showed that 2 or 3 applications at intervals of 3 weeks kept its numbers below 2 to a tree. The correct time for applying the spray varies with the locality and the individual season, and should be determined according to the numbers of the Capsid present, the time of flowering and the amount of crop expected. Thus, if flowering is expected about mid-March, it may be sufficient to make the first application at the end of January and the second in the second half of February. If the crop appears likely to be very valuable, 10 trees in each block of about 10 acres should be sprayed every week, and whenever the number of *Lygus* is found to be above 3–4 individuals to a tree, the whole block should be sprayed. This method, apart from enabling almost the whole of the potential crop to be realised, will probably entail less spraying, since only blocks that require treatment will be sprayed. Moreover, if the spray is applied when there are only 4 bugs to the tree, it will often be considerably more than 3 weeks before their numbers have again reached this level. Experiments against *Antestia* indicate that a mortality of about 95 per cent. can be obtained by one application of the spray. In order to prevent injury to the foliage, only a highly refined, lighting kerosene, containing a low proportion of unsaturated hydrocarbons should be used. In an appendix (pp. 13–18) a routine method is outlined by which natives employed for the purpose can obtain data on the prevalence of different insects, etc., in coffee plantations, on the basis of which control measures can be economically applied.

Céard (L.) & Raynaud (R.). **La palmeraie de Colomb-Bechar.**—*Arch. Inst. Pasteur Algérie*, viii, no. 3–4, pp. 396–465, 18 pls., 82 figs., refs. Algiers, 1930. [Recd. November 1932.]

One of the causes affecting the condition of date palms in Colomb-Bechar, southern Algeria, is infestation by the Coccid, *Parlatoria blanchardi*, Targ., which was first noticed there in 1920 and increased rapidly in the following years. Both leaves and young fruit are attacked, the latter becoming deformed or failing to develop. Singeing was tried on a few palms with excellent results, but was quickly

followed by re-infestation. Lime-sulphur sprays cleared them of Coccids within six months, but were impracticable on the higher palms. Attention is being devoted to the introduction of predators [*R.A.E.*, A, xiv, 457]. Another Coccid, *Phoenicococcus* (*Sphaerococcus*) *marlatti*, Ckll., has recently been observed on date palms in the same locality, but is apparently rare and does not cause much damage.

HENKEL (J. S.) & BAYER (A. W.). **The Wattle Bagworm** (*Acanthopsyche junodi* **Heyl.**)**: An Ecological Study.**—*S. Afr. J. Sci.*, xxix, pp. 355–365, 5 refs. Johannesburg, October 1932.

The following is taken from the authors' summary: *Acanthopsyche junodi*, Heyl. (wattle bagworm) causes extensive damage to plantations of wattle (*Acacia mollissima*) in Natal. Its natural habitat is the thornveldt, and its zones of distribution vary with climatic cycles. The only indigenous food-plant that plays any important part in maintaining it is *Acacia karroo*. Young tissues are essential for the newly hatched larvae, so that only plants that are flushing when the larvae are distributed are subject to attack. *A. lasiopetala* is immune, owing to its extreme hairiness. The feeding activity of the larvae is largely regulated by the water content of the leaves of their food-plants, and they are killed if this is too high or too low. Mortality during the early larval stages is extremely high, much higher than at any other stage in the life-cycle. If the early larval stages have been survived, the rate of mortality caused by parasites and disease is low. Trees growing in situations subject to sea breezes are immune from bagworm attack. Ecological study indicates that the insect is more likely to be controlled by attacking its early larval stages than at any other stage in its life-cycle. Methods of control suggested include the introduction of sylvicultural methods that will prolong the effect of the winter drought. Experiments on the effect of applications of sodium chloride to the soil indicate that such treatment reduces the intensity of bagworm infestation and increases the rate of mortality of the larvae [*cf. R.A.E.*, A, xx, 110].

RIPLEY (L. B.) & PETTY (B. K.). **Possibility of combating Wattle Bag-worm with insecticidal Dusts.**—*S. Afr. J. Sci.*, xxix, pp. 544–561, 7 charts, 5 refs. Johannesburg, October 1932.

The following is almost entirely taken from the authors' summary: The urgent need for direct methods of controlling *Acanthopsyche junodi*, Heyl., has led to a comprehensive study of the use of toxic dusts against this pest. The principles involved were first investigated in the laboratory and later applied in field tests. Large numbers of isolated bagworms were fed on foliage dusted with various compounds, daily records on mortality and feeding furnishing the required data on toxicity and repellence. Practical uniformity as regards temperature, humidity, and light was maintained throughout the experiments. An apparatus for applying uniform and controlled weights of dust per surface area of foliage and a simple method for rating gustatory repellence on a numerical basis are described. Data have been obtained on the relative efficacy and relative repellence for 12 different poisons at varying dosages, and from these data the relative toxicity has been deduced. Field and laboratory results on relative

efficacy are in agreement. The poisons in order of efficacy are: Paris green (copper aceto-arsenite), sodium ferric fluoride, sodium fluosilicate, natural and synthetic cryolite (sodium aluminium fluoride), calcium arsenate, barium fluosilicate, calcium fluosilicate, Schweinfurth yellow, copper carbonate, a proprietary dust containing 35 per cent. calcium arsenate, used extensively in Europe, sodium chromic fluoride and ferric oxide. Sodium ferric fluoride and sodium chromic fluoride are new compounds, and the former is of particular promise as an insecticide for use on plants, combining high toxicity with fairly low solubility, the latter property being essential if plasmolysis is to be avoided. Its positive electric charge is also advantageous, since it tends to increase the adhesion of the powder to the foliage, which bears a negative charge. High repellence, high efficacy and high toxicity are correlated in this instance, but these relations are not necessarily of general application. Toxicity and repellence increase with the solubility as regards the three fluosilicates studied, but this relation does not apply to the double fluorides. The rate of reduction of efficacy as well as of repellence caused by progressively decreasing the amounts of dust applied to the foliage varies markedly according to the poison. The lowest rates of efficacy reduction are found with poisons of highest toxicity. With poisons combining a high rate of repellence reduction with a low rate of toxicity reduction, smaller applications may in some cases be more efficacious than larger ones. When kaolin or calcium hydrate are used as diluents, the toxicity and repellence are lowered considerably more than by an equal decrease in dosage without a diluent. This effect with the former is probably physical, whereas with the latter there are, in most cases, additional chemical causes, calcium salts of low solubility being formed. The reduction of the efficacy of calcium arsenate by diluting with lime has not been previously observed and its cause is not understood. The interaction between sodium fluosilicate and calcium hydrate takes place on the foliage or during storage and not in the digestive tract of the bagworm.

The third instar is no more susceptible than the full grown larva to the toxic effects of most poisons, but calcium arsenate is exceptional, being relatively more toxic to the younger larvae. Older larvae appear to be generally more sensitive than younger ones to the gustatory repellent action of the poisons, but calcium arsenate is again exceptional, repelling the third instar more than the full-grown larvae.

ŞEVKET (N.). **Garbî Anadolu Zararli Haşereleri.** *Hysteropterum grylloides* **F. Rhynchota. Cicad. Fulgoridae.** *Rhaphidopalpa foveicollis* **Luc. (Col. Chrysomel.).** [Pests in West Anatolia. *H. grylloides, R. foveicollis.*]—*Ziraat gaz.* [*Agric. Gaz.*], **1932**, no. 9, reprint 8 pp., 3 figs. Ankara, 1932.

In Anatolia the young shoots of vines, figs, olives and sometimes fruit trees are attacked by the larvae and adults of the Issid, *Hysteropterum grylloides*, F. It does not occur in vineyards in which measures are taken every second year against the vine moth [*Polychrosis botrana*, Schiff.]. In the case of olive trees the best method is to destroy the earthen nests with a brush or rag dipped in kerosene. The Galerucid, *Rhaphidopalpa foveicollis*, Luc., feeds on the leaves of melons in May and oviposits in the ground near the roots. The larvae attack the roots, causing the plants to wither.

MALENOTTI (E.). **Sugli effetti differiti di alcuni insetticidi invernali.** [On the delayed Action of some Winter Insecticides.]—*Giorn. Agric. Domenica*, 1932, no. 43, reprint 9 pp., 4 figs. Rome, 23rd October 1932.

In experiments near Verona, tar distillate sprays were applied against the hibernating larvae of the apple race of *Hyponomeuta padellus*, L., in November and March. Examinations of the apple trees in December and March failed to reveal sufficient insecticidal effect to justify the treatment, and though the emergence of the larvae from their winter shelters in spring was delayed, no significance was attached to this until in June the treated trees were found to be free from infestation, whereas others were severly attacked. The author concludes that the insecticide kills the larvae when they emerge from their shelters in spring. He states that in a district in North Italy where a tar distillate is largely used in winter no serious injury by *H. padellus* has occurred for some years.

OPPI (E.). **Va bene il polisolfuro di calcio contro le cocciniglie del pesco ?** [Is Lime-sulphur suitable against Coccids infesting Peach ?]—*Il Coltivatore e Giorn. vinic. ital.*, 1932, no. 43, reprint 6 pp. Casale Monferrato, 1932.

In experiments in February 1932 against *Diaspis leperii*, Sign., on peach in Verona, lime-sulphur was ineffective, but a tar distillate gave excellent results.

SCHWERDTFEGER (F.). **Die Erholungsfähigkeit von Kiefernbeständen nach Spannerfrass.** [The Capacity for Recovery of Pine Stands after Attack by the Pine Geometrid.]—*Z. Forst- u. Jagdwes.*, lxiv, no. 11, pp. 641–679, 26 refs. Berlin, November 1932.

The decision as to whether stands of pines that have been attacked by Lepidopterous larvae are to be felled depends on a knowledge of their capacity for recovery and on other factors, including the position as regards infestation by secondary pests, particularly bark-beetles. This paper records in detail investigations made in the Letzlinger district of Germany since 1930 in 533 pine stands attacked by the pine Geometrid [*Bupalus piniarius*, L.] in 1928 and 1929. On the basis of these studies, an outline is given of practical rules to be followed in cases in which infestation has only lasted for one year or has lasted for two years but been slight in the second. In such cases complete restoration of the foliage can be expected. The same rules may, however, also prove of value even after two severe attacks in consecutive years. These are that felling must be limited to trees that are definitely incapable of recovery, clear felling being therefore avoided, and that infestation by secondary pests must be prevented by the intensive application of measures such as exposure of trap logs and removal of the bark of all felled trees. The viability of a tree must be ascertained between the end of July and the end of August in the year following that in which the attack occurred. Trees that have put forth few or no shoots and have a cambium with brown spots are not viable and must be felled in autumn or winter. If the attack is renewed in the second year, the same procedure must be repeated in the following one. As an exception, trees obviously dying and sure to be infested by secondary pests should be felled immediately the larvae of *Bupalus* have ceased feeding.

This also applies to trees already infested by bark-beetles. Clear felling should never be practised unless the timber can be disposed of promptly, owing to the opportunities that it otherwise affords for the breeding of secondary pests.

SCHWERDTFEGER (F.). **Die Bekämpfung der Forleule mit Calciumarsenit und Motorverstäuber in der preussischen Staatsoberförsterei Zawadzki, Oberschlesien.** [The Control of the Pine Moth with Calcium Arsenite and Power Dusters in the Prussian State Forestry Division of Zawadzki, Upper Silesia.]—*Z. Forst- u. Jagdwes.*, lxiv, pp. 146–167, 15 figs., 16 refs. Berlin, March 1932. **Forleulenbekämpfung in der preussischen Staatsoberförsterei Neuendorf, Regierungsbezirk Potsdam.** [Pine Moth Control in the Prussian State Forestry Division of Neuendorf, District of Potsdam.]—*Deuts. Forst-Ztg.*, xlvii, no. 40, pp. 847–849. Neudamm, 30th September 1932. **Forleulengefahr und Forleulenbekämpfung.** [Danger from and Control of the Pine Moth.]—*Deuts. Forstw.*, xiv, no. 79, pp. 549–552. Berlin, 30th September 1932. **Prognose und Bekämpfung von Forleulenkalamitäten.** [The Prediction and Control of Outbreaks of the Pine Moth.]—Demy 8vo, 74 pp., 7 figs., 3 pp. refs. Berlin, Verlag "Der Deutsche Forstwirt," 1932.

The first of these papers on the pine moth, *Panolis flammea*, Schiff., describes the measures taken against it in a forestry division in Upper Silesia where pines over an area of about 5,400 acres were infested in 1930. Based on the figure of 500 mature larvae per tree-crown, a dangerous infestation over some 430 acres in 1931 was anticipated, and these stands were treated by means of a power-duster with a calcium arsenite dust containing 20 per cent. As_2O_3 between 19th June and 1st July when over half the larvae were in the final instar. Collection of excreta in 6 stands showed the percentages of mortality in them to be 100, 100, 95, 88, 70, and 70. Even with a mortality of 70 per cent., sufficient larvae were killed to remove the dangerous character of the infestation. No harm was done to birds, game or parasites, but where more than 44 lb. of dust per acre was applied serious scorching of the needles occurred, so that the use of this insecticide is not advocated.

The second paper describes the dusting from an aeroplane in June 1932 of over 6,000 acres near Potsdam. Four contact insecticides were applied, including Forestit [*R.A.E.*, A, xx, 314, 505]. Before 15th June 100 per cent. mortality was obtained ; the effect was less marked afterwards, in accordance with the known fact that the larvae become more resistant as they mature. No harm was caused to birds and mammals. This first large-scale application of contact poisons showed that their early use can save trees injured in the preceding year. Usually such trees have been excluded from treatment with stomach poisons, as they have only a few needles so that most of the insecticide falls to the ground.

The third article draws attention to the fact that in eastern Prussia outbreaks of *P. flammea* have occurred at intervals of 10 years. Its abundance in 1932 indicates the probability of serious infestations in 1933, and a brief survey is therefore given of the various measures that may be employed against it.

The fourth paper is issued in the form of a booklet for foresters, in view of the threatened outbreak of *P. flammea* in 1933 in various

parts of northern Germany, following its abundance there in 1932. A short account of its biology is followed by directions as to the methods for estimating the character of an impending outbreak and for its control.

ECKSTEIN [K.]. **Starkes Auftreten der Eichenminiermotte** *Tischeria complanella* **Hb.** [An Abundant Occurrence of the Oak Miner, *T. complanella*.]—*Anz. Schädlingsk.*, viii, no. 11, p. 143. Berlin, November 1932.

The Tineid, *Tischeria complanella*, Hb., infested oak stump shoots so severely in a forest in Pomerania that up to 50 per cent. of the leaves were mined. Polewood 22–45 years old and trees 60–70 years old were also attacked.

KLEE (H.). [**Measures against Wheat Gall-midges.**]—*Ernährung der Pflanze*, xviii, no. 18, 1932. (Abstract in *Anz. Schädlingsk.*, viii, no. 11, pp. 143–144. Berlin, November 1932.)

Contarinia tritici, Kby., and *Sitodiplosis mosellana*, Géh., are serious pests of wheat in Germany, especially in the island of Fehmarn. Control is possible only when the mature larvae have migrated from the ears to the ground. Strewing kainit immediately after ploughing was found to be the best method of destroying them. When this was done in autumn, 80·3 per cent. were destroyed, the same treatment in spring killing 78·4 per cent.

BALACHOWSKY (A.). **Le pou de San José** (*Aspidiotus perniciosus* **Comst.**) **menace permanent pour les cultures fruitières européennes.** —*Rev. Path. vég. Ent. agric.*, xix, no. 4, pp. 130–166, 2 pls., 31 refs. Paris, 1932.

In consequence of the author's discovery of *Aspidiotus perniciosus*, Comst. (San José scale) on apples from America bought in Paris [*R.A.E.*, A, xx, 256], a series of inspections of imported apples was made on various dates, and as a result of the high percentage found infested, a quarantine inspection service has been established at the different ports. Already consignments of infested apples from the United States and Argentina have been intercepted, and *Chionaspis furfura*, Fitch, has also been found on apples from the United States. The author discusses the importance of the fruit trade between America and France and the percentage of infestation on fruit from America, and gives an account of the origin and distribution of *A. perniciosus*, with notes on its bionomics and systematic position with a detailed description of the mature female. The measures that have been devised against it in America are explained, the danger of infestation spreading to European orchards being pointed out, and other countries of Europe are urged to take the same precautions as France has done to prevent its establishment on the Continent. The text of the legislation regarding it passed by the French government in the spring of 1932 is given verbatim. The import into and transit through France of all plants or parts of plants liable to carry it, coming from the United States, Australia, Canada, China, Japan, New Zealand, Argentina, South Africa, Hawaii or Mexico are prohibited. The import of fresh fruit from other countries is authorised only on production of a certificate indicating the place of origin.

Riols (P.). **A propos d'une galéruque, parasite du fraisier dans la région de l'Est** (*Galerucella tenella* **Linné**).—*Rev. Path. vég. Ent. agric.*, xix, no. 4, pp. 176–178, 1 ref. Paris, 1932.

Galerucella tenella, L., is recorded from Moselle, France, as causing injury to strawberry plants, both surfaces of the leaves of which were found to be eaten by the larvae during June 1932. The adult is briefly described. *G. tenella* has been previously known to attack *Spiraea ulmaria*, causing injury similar to that observed on strawberry. Hibernation probably occurs in the strawberry plantation, judging from the extension of the foci of infestation observed from year to year. The larvae hatch in June and in the laboratory pupated at the bases of the leaf petioles early in July, the adults appearing from 13th to 23rd July. In nature pupation probably takes place at the base of the plant at a slight depth in the soil or on the surface beneath withered leaves. It is suggested that the beetles might be controlled by arsenical sprays after the fruit has been harvested at the end of July, and before they have left the plants for hibernation.

Faes (H.). **Station fédérale d'essais viticoles à Lausanne et Domaine de Pully. Rapport annuel 1931.**—*Annu. agric. Suisse*, xxxiii, no. 3, pp. 153–213, 9 figs. Berne, 1932.

Most of the work done on insect pests of vines has already been noticed [*R.A.E.*, A, xx, 538]. Notes on other insects include an account of an outbreak of the Arctiid, *Paidia murina*, Hb., in June 1931, in the oldest quarters of Vevey and two neighbouring towns. No damage was done but the presence of large numbers of larvae caused much annoyance. They were particularly abundant in the roofs, where during the day they remained motionless on the lower surface of the tiles, emerging at night to feed on the lichens covering the roofs. They were so numerous that in the case of some houses each tile carried 4 or 5. A few entered the living rooms and caused discomfort to the inhabitants.

Papers noticed by Title only.

Rahman (K. A.). **Observations on the immature Stages of some Indian Psyllidae (Homoptera: Rhynchota).**—*Ind. J. Agric. Sci.*, ii, pt. 4, pp. 358–377, 5 pls., 20 refs. Calcutta, August 1932.

Jacobi (E. F.). **De verschillen tusschen de larven van** *Lygus pabulinus* **en** *Plesiocoris rugicollis*. [The morphological and biological Differences between *L. pabulinus* and *P. rugicollis*.]—*Tijdschr. Plantenziekt.*, xxxviii, no. 10, pp. 213–219, 7 figs., 4 refs. Wageningen, 1932. [*Cf.* *R.A.E.*, A, viii, 517; xvi, 619, etc.]

Back (E. A.). **Clothes Moths and their Control.**—*Fmrs' Bull. U.S. Dept. Agric.*, no. 1353 revd., 29 pp., 21 figs., 2 refs. Washington, D.C., April 1932. [*Cf.* *R.A.E.*, A, xix, 760.]

Metzger (F. W.). **Trapping the Japanese Beetle** [*Popillia japonica*, Newm.].—*Misc. Pub. U.S. Dept. Agric.*, no. 147, 8 pp., 4 figs. Washington, D.C., June 1932. [*Cf.* *R.A.E.*, A, xvii, 421; xviii, 644; xix, 354.]

Roark (R. C.). **A Review of recent Moth-proofing Patents.**—*Textile Colorist*, liv, no. 642, pp. 369–374. Philadelphia, Pa., June 1932.

BALL (E. D.), BOYDEN (B. L.) & STONE (W. E.). **Some major Celery Insects in Florida.**—*Bull. Florida Agric. Expt. Sta.*, no. 250, 22 pp., 10 figs. Gainesville, Fla., June 1932.

The most important of the many insects that attack celery in Florida is *Phlyctaenia rubigalis*, Guen. (celery leaf-tier) [see next paper]. The relation between damage by it and winter temperatures is discussed, and its stages are briefly described. During a normal season, four generations occur on celery [*cf. R.A.E.*, A, xix, 717], the numbers diminishing in late May and early June and increasing again about 10th October in the earliest-planted seed-beds, or perhaps not before November in a hot, dry autumn. The eggs are generally deposited in groups of 1–15 on the lower surface of the leaves and are very difficult to locate, being very small and almost transparent. The planted celery is not large enough to furnish shelter for the moths that appear by mid-October, and they seek shelter in the older seed-beds. Many of their eggs and young larvae are destroyed by parasites. The larvae usually require from about 20 days to 3 months to mature, according to temperature, about 4 weeks being the average in normal seasons. Each larva generally eats about $2\frac{1}{4}$ sq. inches of a celery leaf. Natural enemies include three parasites as well as predators and diseases ; by far the most important of these is the egg parasite, *Trichogramma minutum*, Riley. This parasite goes into hibernation for several months, becoming active again a short time before *P. rubigalis* disappears in the spring. It then breeds all the summer on the eggs of various other species of leaf-tiers that infest *Amarantus* and usually becomes abundant in autumn about the time that the fields are being ploughed up and this weed destroyed, after which it concentrates its activities on the eggs of *P. rubigalis*. Various birds feed on the larvae and pupae of the latter, and when pyrethrum dusting drives the moths from the plants, swallows devour numbers of them.

Less important celery pests are *Syngrapha* (*Autographa*) *falcifera*, Kby. (celery looper), which seldom attains serious numbers and is commonly attacked by a bacterial disease ; various cutworms, which might be largely controlled by poison baits ; *Xylomyges eridania*, Cram. (semitropical army worm), which generally damages early planted celery in autumn, subsequently entering hibernation, and can be controlled by spraying with Paris green ; and *Tetranychus telarius*, L., against which a heavy dusting of lime and sulphur, 1 : 3, should be applied as soon as infestation appears.

STONE (W. E.), BOYDEN (B. L.), WISECUP (C. B.) & TATMAN (E. C.). **Control of the Celery Leaf-tier in Florida.**—*Bull. Florida Agric. Expt. Sta.*, no. 251, 23 pp., 10 figs., 2 refs. Gainesville, Fla., July 1932.

During winters of high temperature in Florida considerable damage is done to celery by *Phlyctaenia rubigalis*, Guen. To some extent injury can be avoided by early harvesting, as the most mature plants are preferred for oviposition. Directly after harvest the crop refuse should be ploughed under to destroy the insects left in the field ; if this is not done, the larger larvae can complete their development on the stripped-off leaf stalks, which remain succulent for some time. In laboratory experiments no moths emerged from pupae covered with 1 in. of soil. Passing the celery stalks through a washing machine

on an endless chain removed about 70 per cent. of the larvae when the water pressure was 55 lb. Bordeaux mixture (4 : 4 : 50) is commonly used as a regular weekly spray, and during the early growth of the celery arsenicals are frequently added to control other Lepidopterous pests. A series of laboratory tests has shown, however, that excessive doses of lead arsenate and Paris green are necessary for the control of *P. rubigalis*, and that calcium arsenate is ineffective even when used in large amounts. Experiments with a number of other insecticides proved that pure closed-flower pyrethrum dust of the best grade and Japanese pyrethrum flower dust mixed with 50 per cent. hydrated lime and sulphur dust (used for the control of *Tetranychus telarius*, L.), applied at the rate of 40–50 lb. per acre in two applications about 30 minutes apart [*cf. R.A.E.*, A, xx, 409], were equally successful. The best type of mechanical duster is described ; hand dusters proved practically useless, as the dust must reach the heart of the celery plant in order to be effective. Dusting should be directed against the immature larvae.

STEINER (G.). **Some Nemic Parasites and Associates of the Mountain Pine Beetle** (*Dendroctonus monticolae*).—*J. Agric. Res.*, xlv, no. 7, pp. 437–444, 5 figs., 8 refs. Washington, D.C., 1st October 1932.

Some Nematode associates and parasites of *Dendroctonus monticolae*, Hopk. (mountain pine beetle) are described, the limited observations recorded in the present paper indicating that the Nematode fauna of all bark-beetles of the United States should be investigated, as some of them may prove to be of value as carriers of disease and as consumers of weak or even healthy beetles and their eggs. The relations between bark-beetles and Nematodes are explained, and the taxonomy of the genus *Aphelenchoides* is discussed.

GOFF (C. C.) & TISSOT (A. N.). **The Melon Aphid,** *Aphis gossypii* **Glover.**—*Bull. Florida Agric. Expt. Sta.*, no. 252, 23 pp., 14 figs., 8 refs. Gainesville, Fla., September 1932.

Aphis gossypii, Glov., which is the most serious insect pest of water-melons in Florida, where it has been established for over 30 years, has been taken there from 64 different species of plants. A list of these, including several new records, is given. Cucumbers, cantaloupe melons and okra [*Hibiscus esculentus*] are frequently attacked, egg-plant [*Solanum melongena*], peppers [*Capsicum*] and potatoes being less subject to infestation. Cotton is the only field crop commonly grown in Florida that is injured by *A. gossypii*, but several varieties of *Citrus* occasionally suffer severe infestation. The Aphids overwinter on some of their food-plants, but although *Citrus* is known to serve as a source of infestation, water-melon fields widely separated from citrus groves were infested as early as those close to them. In one field they passed the entire winter on *Eupatorium petaloideum* and were present there when the young melons came up, but in another, where no Aphids could be found at the time of planting, a subsequent infestation was probably due to winged forms coming from a distance.

The winged and wingless viviparous females are briefly described. In life-history studies carried out in an insectary approximating outdoor conditions from 20th May 1930 to 20th May 1931, a first-born

and last-born series of Aphids were reared. Of the first-born series 51 generations were born, and of the last-born series 17. The average number of completed generations for the year was 31½. The nymphal period varied from 3 to 20 days with an average of 7·3; the reproductive period from 2 to 31 with an average of 15·6; and the post-reproductive period from 0 to 21 with an average of 5·3. The length of life varied from 9 to 64 days with an average of 28·4 days, the insects living longest during the coolest weather. The number of young born in one day varied from 1 to 14 with an average of 4·3. All the Aphids were viviparous females, and these produced an average of 67 young each. The most favourable temperature for them seems to be 78–80°F., but they live and reproduce throughout the winter. Migration is accomplished by winged forms, which appear to develop either where the Aphids become overcrowded, or when the plants upon which they are feeding become unfavourable for food.

Predators attacking *A. gossypii*, brief descriptions of which are given, include the Coccinellids, *Hippodamia convergens*, Guér., *Cycloneda sanguinea*, L., *Scymnus terminatus*, Say, and, more rarely, *Olla abdominalis* var. *sobrina*, Csy., Chrysopid larvae, and in smaller numbers the Tenebrionid, *Epitragodes tomentosus*, Lec. The chief parasite is *Lysiphlebus testaceipes*, Cress., and another Braconid, *Trioxys* sp., has also been observed to attack the Aphid.

Control may be effected by nicotine sulphate dust or a spray containing nicotine, pyrethrum or derris. The material and method of application depend largely on the habit of growth of the plants concerned, the state of the weather and the equipment available. Owing to the roughness of the ground and the difficulty of transporting water, dusting seems more practical on water-melons. A funnel of light-weight galvanised iron sheeting has been devised to make dusting possible regardless of wind, a pipe about 2 ft. long connecting it with the duster hose. Instructions are given to growers for making their own dust, thus effecting considerable reduction in the cost. A 3 per cent. dust, which is commonly used, requires 7·5 lb. 40 per cent. nicotine sulphate to 92·5 lb. lime or 6 lb. 50 per cent. free nicotine to 94 lb. lime. A 2 per cent. dust made with 50 per cent. free nicotine, however, is equivalent in effectiveness to a 3 per cent. dust made with 40 per cent. nicotine sulphate, and it is therefore cheaper to make the dust with free nicotine.

Aphids on such plants as egg-plant, okra and peppers, which become too large for dusting under a funnel, can be destroyed by sprays. Various sprays used by other workers on different plants subject to attack by *A. gossypii* are discussed.

Roark (R. C.). **Chemically combating Insect Pests of Foodstuffs.**—*Industr. Engng. Chem.*, xxiv, pp. 646–648, 19 refs. Easton, Pa., June 1932.

The author points out the risks entailed by the use of sprays and dusts for controlling insect pests of food crops, and of fumigants against those infesting stored foodstuffs, including fire hazard with certain fumigants, retention of hydrogen cyanide by products fumigated with hydrocyanic acid gas, and arsenical residues on fruit, and gives a useful summary of recent progress in the development of new insecticides by the use of which such dangers are avoided.

Van Leeuwen (E. R.). **Control of the Japanese Beetle on Fruit and Shade Trees.**—*Circ. U. S. Dept. Agric.*, no. 237, 13 pp., 8 figs., 3 refs. Washington, D.C., June 1932. [Recd. December 1932.]

This circular on the bionomics and control of the Japanese beetle [*Popillia japonica*, Newm.] on fruit and shade trees is an amplification and revision of a paper previously noticed [*R.A.E.*, A, xviii, 250].

Folsom (J. W.). **Insect Enemies of the Cotton Plant.**—*Fmrs.' Bull. U. S. Dept. Agric.*, no. 1688, 28 pp., 34 figs., 9 refs. Washington, D.C., July 1932. [Recd. December 1932.]

This bulletin deals with the habits and control of the major and minor pests of cotton in the United States and is a revision of, and supersedes, one already noticed [*R.A.E.*, A, vi, 247]. Calcium arsenate dust is now considered the best stomach poison for the control of *Anthonomus grandis*, Boh., and other chewing insects on cotton. Additional pests mentioned are : *A. grandis thurberiae*, Pierce, which infests the bolls ; *Psallus seriatus*, Reut. (cotton flea-hopper), which punctures the stems, branches, leaves and small buds ; *Bucculatrix thurberiella*, Busck (cotton leaf perforator), which mines the leaves ; *Lygus pratensis*, L. (tarnished plant bug), which destroys the young buds ; *L. elisus*, Van D. (cotton dauber), which causes the fall of buds, flowers and young bolls ; and *Loxostege similalis*, Gn., which webs the foliage.

Quaintance (A. L.), Porter (B. A.) & Snapp (O. I.). **The Peach Borer—How to prevent or lessen its Ravages ; the Paradichlorobenzene Treatment.**—*Fmrs.' Bull. U. S. Dept. Agric.*, no. 1246, 12 pp., 10 figs. Washington, D.C., July 1932.

This is a revised bulletin [*cf. R.A.E.*, A, x, 186] on the bionomics of *Aegeria exitiosa*, Say (peach borer) in the United States, and its control, chiefly by means of paradichlorobenzene. The wash previously recommended [*loc. cit.*] is now omitted.

Mackie (D. B.). *Ephestia figulilella* **Greg. A Storage Pest taken feeding upon fresh Grapes.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 7–9, pp. 311–315, 2 figs. Sacramento, Cal., 1932.

Ephestia figulilella, Gregson, was discovered attacking ripening grapes in California in 1924 and 1929, and was subsequently found to be present in vineyards in a number of counties in the State [*cf. R.A.E.*, A, xx, 174, 585]. Of the 17 varieties of vines observed, all were found to be infested, some, however, being preferred to others. This is probably the first time that this moth has been found attacking fresh fruit in the field. The larvae in feeding on grapes do not confine themselves to one or two, but wander about the bunch eating a little from several berries, sometimes consuming all but the interior of one or more of them. This condition favours the development of mould, and large parts of the bunches soon show decay. In the spring of 1932 the number of overwintering cocoons taken under the bark of vines in one locality was 7·57 times as great as that taken during the same period in the previous year. During the summer of 1932 larvae were also found on ripening figs in another locality, and in small numbers on prunes.

Fleury (A. C.). **Mexican Fruit Fly Infestation in the Lower Rio Grande Valley, Texas.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 7–9, pp. 316–321. Sacramento, Cal., 1932.

In discussing the situation with regard to *Anastrepha ludens*, Lw., on *Citrus* in the Lower Rio Grande Valley in Texas, the author states that the infestation was probably caused through transport of infested fruit from the Gulf States of Mexico to the markets of Matamoros, and natural spread from that town across the Rio Grande. Although the measures enforced [*R.A.E.*, A, xv, 668] have practically rid the region of infestation by the fly, the importation of fruit to Matamoros, which serves as a continual source of reinfestation, precludes the possibility of abandoning them.

Lewis (H. C.). **Citrus Dusting Equipment.**—*Mon. Bull. Dept. Agric. California*, no. 7–9, pp. 324–339, 9 figs., 2 refs. Sacramento, Cal., 1932.

Details are given of the development and operation of various types of machinery used for applying sulphur dust against certain pests of *Citrus* in California, with brief notes on costs and the precautions necessary to prevent accidents and injury to the foliage.

Keifer (H. H.). ***Dinocleus pilosus* Lec. as a Garden Pest.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 7–9, p. 339. Sacramento, Cal., 1932.

Adults of the weevil, *Dinocleus pilosus*, Lec., are recorded as having caused serious damage to carrots and sunflowers in one locality in California during May 1931.

Browne (A. C.). **A new Host for Elm Leaf Beetle.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 7–9, p. 347. Sacramento, Cal., 1932.

In August 1932 adults of the elm leaf beetle [*Galerucella luteola*, Müll.] were observed in western California causing severe injury to the leaves of beans about 400 feet away from elms that had been defoliated by them. The only other instance observed in California of the beetles feeding on a plant other than elm was in 1923, when they attacked the foliage of almonds.

Krebs (H. M.). **The Wax Moth as an Enemy of Bees.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 7–9, pp. 350–353. Sacramento, Cal., 1932.

A somewhat popular account is given of the economic importance, bionomics and control of the wax moths, *Galleria mellonella*, L., and *Achroia grisella*, F., in California [*cf. R.A.E.*, A, xviii, 485]. The author considers that since the introduction of the Italian bee and the movable frame hive, these pests have been practically eliminated from modern apiculture, and are able to do little damage to the combs except those in storage, as they only thrive among black bees and in carelessly kept hives. The moths are not such serious pests of stored combs in the northern United States as they are in the southern, since any eggs present in the combs are killed by frost.

Burke (H. E.). **Summary of Shade-tree Insect Activities in California for 1931.**—*Mon. Bull. Dept. Agric. California*, xxi, no. 7–9, pp. 358–369, 7 figs. Sacramento, Cal., 1932.

Among the numerous insects observed attacking shade trees in California during 1931, *Malacosoma constricta*, Stretch, was more common on deciduous oaks than on evergreen ones. The winter is passed in the egg stage on the twigs, the larvae hatching in early spring and attacking the new leaves. *Epinotia subviridis*, Heinr., caused injury to cypress [*Cupressus*] during February-May. The larvae eat through the foliage, which becomes brown, and web pieces of twigs and leaves into small nests. They become full grown between mid-February and mid-May and pupate in these nests, the adults emerging in about 2 weeks. Oviposition occurs on the scales of the twigs. A combined oil-nicotine spray applied to the foliage about 1st May should prove effective. Cypress was also attacked by the larvae of *Argyresthia cupressella*, Wlsm., which mine in the small twigs, causing the foliage to turn brown. They hibernate in the mines and do most of their feeding in early spring. In March and April they spin cocoons on the surface of the twigs, the adults appearing about two weeks later. The eggs are laid in the crevices between the leaf scales. This Tineid could probably be controlled with the oil-nicotine spray recommended against *E. subviridis*. *A. trifasciae*, Braun, and *A. franciscella*, Busck, are often found associated with it and cause similar damage. *Haltica bimarginata*, Say (alder flea-beetle) was present in large numbers in several localities. Both adults and larvae feed on the leaves. The eggs are laid on the leaves in June and July and hatch in about a week. The larvae pupate in August, and the adults emerge and feed until the end of September, when they enter hibernation. A spray of 4 lb. lead arsenate and 100 U.S. gals. water, applied against the overwintered adults as soon as the leaves unfold, will give good control.

Neochmosis (*Dilachnus*) *tujafilinus*, Del G., which attacks cypress and arborvitae [*Thuja*] was the most serious pest of Monterey cypress [*Cupressus macrocarpa*] in one locality. The Aphids, which occurred in the thickest growth, exude quantities of honeydew that favours the development of mould, with the result that a great deal of the foliage is killed. Spraying with 1½–2 per cent. lime-sulphur containing nicotine sulphate (1 : 800) gave good control, and a combined oil-nicotine spray was also of value in nurseries. *Toumeyella pinicola*, Ferris, which hibernates on the twigs as a fertilised female, was rather common on several species of pine in one locality. It kills numerous twigs, and sooty mould is associated with it on the foliage. It is frequently reduced to moderate numbers by Coccinellids such as *Hyperaspis undulata*, Say. *Physokermes insignicola*, Craw, which causes similar injury, was fairly abundant on Monterey pine [*Pinus radiata*]. Hibernation occurs as a second instar larva, the female larvae resting on the year-old bark of the twigs, and the male larvae on the flat sides of the needles. In one locality *Aonidia shastae*, Coleman, was quite numerous on *Sequoia washingtoniana* growing in the shade.

Pityophthorus carmeli, Sw., which has recently become an important pest, causes serious injury to various species of pine. It has several generations in a year. Two other Scolytids, *Phloeosinus cristatus*, Lec., and *P. cupressi*, Hopk., have been responsible for the death of a large number of *Cupressus*, *Thuja* and allied trees. The former, which has one complete and a partial second generation a year, usually

hibernates as a full-grown larva in a cell in the outer wood or inner bark; the adults that emerge in the autumn and probably some adults of the first generation hibernate in the twigs. *P. cupressi* occurs in the fog belt on the coast and has several generations a year. *Chrysobothris nixa*, Horn, which has one generation a year, was found killing arborvitae in a nursery, and also infested *Cupressus* spp. and incense cedar [*Libocedrus decurrens*]. *Agrilus angelicus*, Horn, which takes nearly two years to reach the adult stage, caused injury to evergreen oaks in two districts.

Essig (E. O.). **A Genus and Species of the Family Aphididae new to North America.**—*Univ. California Pub. Ent.*, vi, no. 1, pp. 1–8, 1 pl., 8 figs., 7 refs. Berkeley, Cal., 27th October 1932.

The apterous and alate ovoviviparous females of *Thoracaphis umbellulariae*, sp. n., are described from California laurel (*Umbellularia californica*) in California. The Aphids, which only occur on the lower surface of the leaves, were first noticed in November 1929 and were abundant in September 1931 and again in 1932, particularly in October, when winged individuals and nymphs predominated. A few isolated colonies were found on *Sassafras variifolium*. The insect is compared with related species.

McKenzie (H. L.). **The Biology and Feeding Habits of *Hyperaspis lateralis* Mulsant (Coleoptera-Coccinellidae).**—*Univ. California Pub. Ent.*, vi, no. 2, pp. 9–20, 2 pls., 4 figs., 6 refs. Berkeley, Cal., 8th November 1932.

The Coccinellid, *Hyperaspis lateralis*, Muls., all stages of which are described, is a native species occurring in the south-western parts of the United States, where it is chiefly predacious on mealybugs. In California it has been found attacking *Pseudococcus sequoiae*, Coleman, *P. aurilanatus*, Mask., *P. ryani*, Coq., *P. citri*, Risso, and *Erium lichtensioides*, Ckll. The adult, immediately after emergence, seeks out mealybugs and in their absence may attack Aphids. Pairing takes place almost at once, and oviposition begins 10–15 days later. The eggs are deposited at random on the twigs or under adult mealybugs. Under laboratory conditions the life-cycle in autumn required about 53 days and in the spring about 35. There may be a third generation but this has not yet been determined. A Hymenopterous parasite is sometimes obtained in great numbers from both larvae and pupae, and larvae of the green lacewing, *Chrysopa californica*, Coq., have been found feeding upon the eggs.

Dozier (H. L.), Williams (L. L.) & Butler (H. G.). **Life History and Habits of the Plum Curculio in Delaware.**—*Bull. Delaware Agric. Expt. Sta.*, no. 175, 43 pp., 17 figs., 31 refs. Newark, Del., April 1932. [Recd. December 1932.]

An account is given of investigations in Delaware during 1928–30 on the bionomics of *Conotrachelus nenuphar*, Hbst. (plum curculio), with particular reference to the damage it causes to peaches [*cf. R.A.E.*, A, xvii, 389; xviii, 419].

The following is taken from the authors' summary: Considerable mortality occurs among the hibernating adults, owing to frequent sudden changes of temperature, varying degrees of snow and rain, and lack of suitable over-wintering quarters. Emergence usually begins between 5th and 20th April, but it is greatly influenced by the

temperature, the peak varying by as much as a month in different years. A maximum of about 75–80°F. with a mean of about 55–60°F. for two consecutive days is necessary to induce activity in spring. The greatest numbers of adults appear when a maximum of 90°F. with a mean of about 75°F. occurs for two consecutive days, regardless of the time that has elapsed since the first emergence. This has a direct bearing on the timing of the early spray applications. Approximately the same period was required for development in the central and southern parts of the State. In the former, the egg stage from May to July averaged 6·4 days in 1928 and 7·3 in 1929, with a maximum of 16 and a minimum of 3 according to the temperature. The larval period averaged 15·8 days in 1928 and 17·2 in 1929, with a maximum of 35 and a minimum of 10. The time that the first mature larvae leave the fallen fruit is determined by the size and suitability of the fruit and by the seasonal conditions. The newly-set fruits begin to drop soon after they are " stung," but many of those attacked remain on the tree until the larvae are nearly full-grown. Fallen peaches that are less than ½ in. long do not usually contain sufficient food for one larva. Peaches are subject to one or more periods of physiological dropping of the fruit. The fall immediately preceding the so-called June drop is largely the result of infestation by *C. nenuphar* in Delaware. It generally begins between 15th and 25th May, depending on the development and the size of the fruit, and is heaviest within 10–12 days. Most of the larvae leave the fruits for pupation about 6 days later. The importance of picking up the fallen fruit as early as 24th May is thus emphasised. The length of time spent in the soil averaged 28 days in 1928 and 30·7 in 1929, with a maximum of 61 and a minimum of 15. Adults emerged between 6th July and 9th October in 1928 and between 29th June and 4th November in 1929.

No evidence was obtained of a second brood in the centre or north of Delaware during the investigations [*cf.* xix, 340] but in the south eggs of a second brood were obtained from 13th July to 30th August 1929, the maximum being laid on 1st August. The larvae issued from the fruit between 26th July and 17th September, the greatest number appearing on 20th August. Adults emerged between 10th September and 8th November. Adults of *C. nenuphar* are capable of living for over a year, and those of two years may occur together from July to October, inclusive. Adults were collected on peach trees in the southern area as late as 14th October, 3 days after frost had occurred, indicating that they may remain late in the orchard before seeking hibernation quarters.

It is evident that the spray programme must be adjusted to the seasonal variations in development.

Three Hymenopterous parasites were obtained, *viz.*, *Anaphoidea conotracheli*, Gir., which sometimes destroyed over 50 per cent. of the eggs, *Triaspis curculionis*, Fitch, which principally attacked the larvae of the early first brood, and *Thersilochus conotracheli*, Riley, which was not abundant.

DOZIER (H. L.), WILLIAMS (L. L.) & BUTLER (H. G.). **Life History of the Grape-berry Moth in Delaware.**—*Bull. Delaware Agric. Expt. Sta.*, no. 176, 47 pp., 13 figs., 17 refs. Newark, Del., April 1932. [Recd. December 1932.]

Polychrosis viteana, Clem. (grape-berry moth) occurs principally in the east and middle west of the United States and in the east of Canada,

where there are many wild and cultivated varieties of vine. An account based on observations during 1928–30 is given of its bionomics in Delaware [*cf. R.A.E.*, A, xvii, 373 ; xviii, 279], where if unchecked it may cause more damage than all the other insect pests of grapes combined. The Mymarid, *Camptoptera pulla*, Gir., was reared from the eggs, this being the first definite host record for this parasite, and larvae of the Telephorid, *Chauliognathus marginatus*, F., were predacious on the larvae, and also attacked those of the codling moth [*Cydia pomonella*, L.], being very numerous under shelter bands on apple trees and among fallen apples.

PEPPER (J. H.). **Observations on a unidirectional Flight of Army Cutworm Moths and their possible Bearing on Aestivation.**—*Canad. Ent.*, lxiv, no. 11, pp. 241–242. Orillia, Ont., November 1932.

The larvae of *Chorizagrotis auxiliaris*, Grote (army cutworm) hibernate in the soil and mature early in the spring. The flight of the adults occurs in June, and the moths disappear almost completely between the early part of July and the latter part of August. It has been considered that this period of aestivation is passed under clods of earth, matted weeds, etc., in the locality in which the larvae developed. *Agrotis ypsilon*, Hfn., which is a pest in Egypt and certain parts of India, has a similar life-history, but there is evidence that the moths migrate away from cultivated areas prior to the summer, which they pass elsewhere [*R.A.E.*, A, xiii, 610; xx, 475].

C. auxiliaris was abundant in parts of Montana and Alberta during 1931, the moths being found sheltering in barns and under boards, etc., at any time of day. Near Bozeman, Montana, a rather definite flight in one direction occurred at sunset on 14th July, and observations were carried out daily until 17th July and also on 20th July, after which no individuals could be found, despite intensive search. The data obtained indicated that the maximum flight took place about 8.30 p.m. chiefly in a south-westerly direction and that it was not apparently related to temperature, humidity or wind. The numbers observed per minute on the successive dates decreased quite rapidly during the investigations. It is possible that a migration occurs to higher altitudes where aestivation may be completed at lower temperatures than on the plains ; this suggestion is supported by the fact that intensive search failed to reveal moths at midsummer in areas of outbreaks on the plains, and that they do not survive the summer in outdoor cages, though they may do so if kept at an average temperature of 37°F.

WALLEY (G. S.). **New Canadian Tryphoninae (Hymenop. ; Ichneumonidae).**—*Canad. Ent.*, lxiv, no. 11, pp. 242–247. Orillia, Ont., November 1932.

Four new species of *Euceros* are described, including *E. decorus* reared from *Lygaeonematus erichsoni*, Htg., in Manitoba, and *E. neodiprioni* from cocoons of *Diprion* (*Neodiprion*) sp. attacking *Pinus banksiana* in Quebec.

BEALL (G.). **The Efficiency of Traps in controlling the European Earwig,** *Forficula auricularia*, **Linn., in British Columbia.**—*Bull. Brooklyn Ent. Soc.*, xxvii, no. 5, pp. 231–238, 1 fig. Brooklyn, N.Y., 1932.

Experiments with different types of traps against *Forficula auricularia*, L., in British Columbia, showed that those placed in trees

catch at least 4–5 times as many earwigs as those on the ground. This is probably due to the fact that the earwigs, particularly those that have completed the second instar, climb freely and tend to concentrate on the trees. Jute sacking bundled in the crotch of a tree is the most effective trap in practice, because although it does not attract many earwigs, it can be emptied with a minimum of effort. Jute sacking tied round a tree is about 1·3 times, and newspaper bundled in the crotch about 4 times, as effective as a sack bundled up, but both require a disproportionate amount of time to empty. Old, dry dahlia stems laid on the ground are very effective for catching young nymphs, bamboo sections being much less so. Inverted pots with grass, placed on stakes, are moderately effective when set among dahlia foliage. They are 2·5 times as efficient as tins containing newspaper, similarly placed. Kitchen beef dripping applied to traps raised the catch of earwigs 1·4 times against that of unbaited traps. Lump sugar reduced the catch, possibly because it attracted many ants and these tended to disturb the earwigs. A comparison of the season's catch (May–October) from plots in which earwigs were destroyed and from controls where they were captured and then set free showed a certain amount of reduction of numbers to occur in the former. Migration of the earwigs is so rapid, however, that trapping is valueless as a control measure if only practised on one plot.

Criddle (N.). **The Correlation of Sunspot Periodicity with Grasshopper Fluctuation in Manitoba.**—*Canad. Field Nat.*, xlvi, no. 9, pp. 195–198, 1 fig., 16 refs. Ottawa, December 1932.

Between 1800 and 1930 there have been at least 32 years in which grasshoppers have been abundant in Manitoba. A comparison of the dates of outbreaks with a chart of the fluctuations in sun-spots suggests a correlation between sun-spot minimum and a rise in the number of grasshoppers. This is probably due to the effects of sun-spots on meteorological conditions, particularly on the amount of rainfall, which is less during periods of sun-spot minimum. The cases in which grasshopper activities in Manitoba appear to contradict the sun-spot theory may be explained by invasions from southern areas, where an increased, and not a reduced, amount of rainfall should be beneficial to the increase of grasshoppers.

The sun-spot conditions during the present outbreak indicate that the latter should have reached its maximum in 1932, but exact forecasts are impossible at present since the whole phenomenon is very complicated and other factors, particularly natural enemies, play a part on grasshopper periodicity.

Schultz (E. F.). **La extirpación de las principales cochinillas que infestan los " Citrus " en Tucumán.** [The Eradication of the principal Coccids infesting Citrus Plants in Tucumán.]—*Rev. industr. agric. Tucumán*, xxii, no. 3–4, pp. 73–75. Tucumán, 1932.

The common Coccids infesting *Citrus* in the province of Tucumán, Argentina, are *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.), *Lepidosaphes beckii*, Newm., *Coccus hesperidum*, L., and *Prontaspis* (*Chionaspis*) *citri*, Comst. Oil sprays are recommended against them. *Icerya purchasi*, Mask., has recently been found in the Province, and the Coccinellid, *Rodolia* (*Vedalia*) *cardinalis*, Muls., has been imported to control it.

La Langosta.—*Publ. mens. Direcc. Agron. Minist. Industr. Uruguay*, v, no. 1–2, pp. 1–18, 12 figs., 3 diag. Montevideo, 1932.

A general outline of the life-history of *Schistocerca paranensis*, Burm., is given, and the usual methods of control are described, with diagrams illustrating the seasonal movements of swarms in Uruguay during the outbreak of 1914–18. Extracts from the local anti-locust legislation are appended.

Bacigalupi (R.). **La lucha contra la langosta.**—*Publ. mens. Direcc. Agron. Minist. Industr. Uruguay*, v, no. 1–2, pp. 19–21. Montevideo, 1932.

During 1915–18 all the provinces of the Republic of Uruguay were invaded by locusts [*Schistocerca paranensis*, Burm.], but the invasion now in progress had not reached such dimensions by September 1932, the eastern provinces being free from the insect, though it may spread to them at the end of November. The general arrangements made for an anti-locust campaign are described.

République Française. Ministère des Affaires Etrangères. **Procès-Verbal des Séances de la Deuxième Conférence Internationale pour les Recherches Antiacridiennes. Paris 15 Juillet–23 Juillet 1932.**—29 pp. Paris, Soc. ent. Fr., 1932.

This Second International Conference for anti-locust research [*cf. R.A.E.*, A, xx, 160], which was attended by official delegates from Belgium, France, the British Empire, Egypt, Spain, Abyssinia, Italy and Liberia, stressed the impossibility of effective control of locusts by the isolated defensive efforts of individual countries and colonies, and the necessity of studying the original breeding areas. Once these areas are known and their condition studied, a policy of prevention of outbreaks can be developed. Actual international co-operation in this respect exists only between Britain, Belgium, France and Italy, and the Conference recommended that a number of other countries in Africa and western Asia should be invited to take part in it.

A general plan of anti-locust research was adopted, consisting of the co-ordination of all information on locusts in one centre, and the Imperial Institute of Entomology was nominated to act as the International Centre for Anti-Locust Research. Field investigations in all the most important areas were discussed, and the task of carrying out the work in each allotted to the respective Government. Seven appendices to the Proceedings contain reports of various delegations and plans for future work. Conventional signs to be used in monthly maps indicating the locust situation prepared by each colony and submitted to the International Centre are reproduced in another appendix. It was decided to hold Conferences of this kind annually, the third to be held in London in 1933.

Rubtzov (I. A.). **On the Estimation of the actual Density of the Grasshopper Population by the Method of Sweeping.** [*In Russian.*]—*Plant Prot.*, 1932, no. 1, pp. 69–80, 9 refs. Leningrad, 1932.

The actual density of a grasshopper population in a given habitat can be estimated almost exactly by counting the insects on plots one

metre square. It is easier, however, to estimate the relative density by sweeping with a net. By averaging the number of grasshoppers caught on ten plots or by a hundred strokes of the net it was found that one stroke of the net reveals only about one-third to one-half the number of individuals counted on one square metre plot. The correlation, however, varies with the density and the height of the grass, since the liability of a grasshopper to be captured decreases when the vegetation is denser and taller. The coefficient of liability to capture can be calculated empirically from a series of catches in different habitats. Similarly, there is a variation in the liability to capture between various species of grasshoppers; the specific coefficient should be calculated by comparison with the common species. The actual density of a grasshopper population may then be obtained by multiplying the relative density (as obtained by sweeping) by the specific and vegetation coefficients.

RUBTZOV (I. A.). **On the Amount of Food consumed by Locusts.** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 31–40, 12 refs. Leningrad, 1932.

Leaves of *Bromus inermis* were given as food to five species of grasshoppers in cages, and the amount consumed each day was measured by means of millimetre squared paper. By calculating the weight from this, it was found that an adult grasshopper devours 30–50 per cent. of its own weight of the grass in a day, and that during its whole development an individual devours 20 times its weight in the adult stage. According to these figures, the losses of grass in a field with a grasshopper population of 10 individuals to a square metre would amount to about 607 lb. an acre. The total loss in eastern Siberia would be about 43,300 tons of hay per year.

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). Methods of determining the Percentage of Infestation by injurious Insects and other Pests of Cotton sown in Rows.** [*In Russian.*]—*Ser. nauchn. Nauchno-issledov. Inst. khlopkov. Promuishl.*, no. 38, 15 pp., 4 graphs, 7 refs. Tashkent, 1931. (With a Summary in English.) [Recd. December 1932.]

The author discusses three existing field methods of determining the extent of the damage caused by various pests to cotton and describes a fourth, which consists of the examination of a given number of plants in each row along a diagonal from corner to corner of the field, together with samples from the outer rows on two opposite sides. The number of plants taken in each row depends on the size of the field and the accuracy required. The comparative efficiency of each method is estimated by means of mathematical formulae, which show that the new one is superior and gives the truest estimate of the losses caused.

[NOVITZKIĬ (V.).] **Новицкий (В.). An Experiment in the Application of Nicodust against the Autumn Generations of the Cotton Aphis.** [*In Russian.*]—*Za khlopkov. Nezavisim.*, no. 4, pp. 52–54. Tashkent, April 1931. [Recd. December 1932.]

As sprays of soft soap against *Aphis gossypii*, Glov., on cotton in eastern Uzbekistan depreciated the quality of the fibre [*R.A.E.*, A, xix, 307], field experiments were carried out in the autumn of 1929 with

a dust containing 1·68 per cent. nicotine with lime as the carrier. Applied with a hand-duster at the rate of about 40 lb. to the acre, it killed on an average 90·7 per cent. of the Aphids without injuring the plants.

[KUZNETZOV (N. P.).] **Кузнецов (Н. П.). Contribution to the Question of the Control of the Red Spider by Means of Flowers of Sulphur.** [*In Russian.*]—*Za khlopkov. Nezavisim.*, no. 4, pp. 54–56. Tashkent, April 1931. [Recd. December 1932.]

Divergent views as to the effectiveness of flowers of sulphur against the red spider [*Tetranychus*] on cotton in the Russian Union are briefly reviewed, and instances are recorded of its application in the Ferghana region in 1930, when after repeated dusting all stages of the mite remained unaffected in most cases. It was found, however, that the dusted plants retained their foliage, whereas in adjoining untreated fields the infested plants lost 75 per cent. of their leaves.

[KOTLYAREVSKIĬ (V. I.).] **Котляревский (В. И.). The Control of** *Caradrina* **on Soviet Farms of the Murghab Group and Baĭram-ali.** [*In Russian.*]—*Za khlopkov. Nezavisim.*, no. 4, pp. 56–57. Tashkent, April 1931. [Recd. December 1932.]

Attention is drawn to the fact that the Paris green spray used against the Noctuid, *Laphygma* (*Caradrina*) [*exigua*, Hb.] in the summer of 1930 in southern Turkmenistan [*R.A.E.*, A, xix, 306] was only effective when it was properly and continuously stirred in the spraying apparatus. In most cases, however, adequate equipment was not available, and the results obtained were very poor.

[MALININ (M.).] **Малинин (М.).** *Megachile argentina* **F. as a Pest of Cotton and other cultivated Plants.** [*In Russian.*]—*Za khlopkov. Nezavisim.*, no. 4, pp. 57–58, 1 ref. Tashkent, April 1931. [Recd. December 1932.]

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). A Note on the Bees of the Genus** *Megachile* **Latr.** [*In Russian.*]—*Op. cit.*, pp. 58–59, 3 figs., 3 refs. Tashkent, April 1931. [Recd. December 1932.]

In the first of these notes, *Megachile argentata*, F., is recorded as attacking the leaves of cotton in July 1930 in a locality in southern Kazakstan. The manner in which the bees cut off portions of the leaf to drag them into their holes in the soil are briefly described. They also attacked the foliage of ground-nuts (*Arachis*), velvet beans [*Stizolobium*], peas, and yellow and white acacia [*Caragana* and *Robinia*].

In the second note general information is given on the habits of bees of the genus *Megachile* and the plants they attack. They may cause considerable damage if present in large numbers, but Hymenopterous parasites play an important part in keeping them in check.

[YAKHONTOV (V. V.).] **Яхонтов (В. В.). The Cotton Stem Moth** (*Platyedra vilella* **Zell.**). [*In Russian.*]—*Za khlopkov. Nezavisim.*, no. 5, pp. 42–47, 6 figs., 12 refs. Tashkent, May 1931. [Recd. December 1932.]

An account is given of observations on *Platyedra vilella*, Zell., carried out in 1926–28 near the town of Old Bokhara, western Uzbekistan. The

adults, larvae and pupae are briefly described. There are at least two generations a year, of which the first develops entirely on the wild malvaceous plant *Althaea officinalis*, which is common, and the second chiefly on cotton. No other food-plants have been found. In spring the adults are on the wing in the second half of April, or earlier if the weather is warm. Eggs are laid singly on the tips of the shoots of *Althaea*, and the young larvae feed for a short time on the tips of the leaves, and then mine in the stems. It is only very seldom that the capsules are attacked. As the larvae prefer to feed on the tender green part of the pith, they migrate to adjoining plants as soon as they reach the coarser part of the stem. The adults of the first generation are on the wing at the beginning of the flowering period of cotton sown in the second part of April, and oviposition takes place almost exclusively on this plant. The behaviour of the larvae is similar to that on *Althaea*. The infested plants become dwarfed and spread horizontally.

Doubt has been expressed as to whether infestation by *P. vilella* is injurious to cotton, its effect being very similar to that produced by nipping off the apical buds, which has been advocated as a means of increasing the yield of bolls in areas where the plants grow rank, provided that it is done after they have produced sufficient fruit-bearing branches. Since in Bokhara cotton does not develop very vigorously and the lower branches bear fruit normally, nipping is unnecessary, and infestation by *P. vilella* is, therefore, injurious. In experiments both infested and nipped plants produced fewer bolls than the control ones. Though *P. vilella* does not occur in great numbers in the district of Bokhara, it may be abundant where *Althaea*, which is its chief food-plant, is available. Infestation of cotton was only observed in the vicinity of this plant and decreased towards the centre of the field, plots at a distance of 1,100 yards from *Althaea* being entirely free from attack. *Althaea* should therefore be destroyed in the spring after the eggs have been laid, and cotton sown as early as possible in order that it may be well advanced when the adults of the first generation appear.

[Stepantzev (I. N.).] **Степанцев (И. Н.). The Self-poisoning of the Larvae of the Maize Tenebrionid on Cotton.** [*In Russian.*]—*Za khlopkov. Nezavisim.*, no. 5, pp. 47–51. Tashkent, May 1931. [Recd. December 1932.]

Details are given of investigations on the Tenebrionid, *Pedinus femoralis*, L., carried out in April and May 1928 in the Stavropol Government (northern Caucasus) in consequence of the observation that the larvae die after feeding on cotton seedlings. From 50 to 86 per cent. of those found in the soil of the cotton experiment field were dead, their bodies being soft and filled with a blackish fluid. The rate of mortality was higher in plots sown in mid-April than in those sown a month later. Since only healthy larvae occurred in adjoining plots of maize, flax, sunflowers, etc., the author believes that the death of the larvae in the experiment field was due to their feeding on cotton. In the laboratory, with only a few exceptions, the larvae that fed on cotton died within 2–13 days, young individuals succumbing soonest. All parts of the stalk proved equally poisonous, though that near the root was preferred by the larvae. Feeding on the more advanced seedlings did not always kill them, probably because they consumed insufficient quantities owing to the comparative toughness of the stem. In one

instance a full-grown larva died on the 17th day after feeding on cotton stems that had previously been boiled for a considerable time, indicating that even under such conditions the poisonous element still remains in the plant. Larvae that were fed on seedlings of castor [*Ricinus communis*] survived, as did those of *Opatrum sabulosum*, L., and *Athous* sp. when reared on cotton. The possible causes of the toxicity of the latter to the larvae of *P. femoralis* are discussed. It is suggested that the resinous substance contained in the plants may form a suitable medium for the development of various pathogenic micro-organisms in the digestive tract, especially as all cotton seedlings in the experiment field were infected with *Glomerella gossypii*, *Fusarium vasinfectum* and *Bacterium malvacearum*.

Since *P. femoralis* is an important pest of wheat, maize, beet, tobacco and a number of other cultivated plants in the northern Caucasus and other parts of the Russian Union, the fact that the larvae are killed after feeding on cotton may be of considerable importance. In the districts of the Ukraine, the northern Caucasus and the Astrakhan Government in which cotton is now grown the beetle may disappear; it is absent from the old cotton areas in Turkestan and Transcaucasia.

[Ustinov (A. A.).] **Устинов (A. A.). A Review of Pests of Tobacco in Abkhazia observed in 1931.** [*In Russian.*]—Roy. 8vo, 38 pp., 4 figs., 12 diag., 17 refs. Sukhum, Abkhazsk. tabachn. zonal'n. Sta., 1932.

The first part of this report deals with the pests found on tobacco in the field in western Georgia, including 33 species of insects, and contains notes on the bionomics and control of the more important ones.

Gryllotalpa gryllotalpa, L., caused serious damage to early planted seedlings; it was ten times as numerous in plots mulched with fern as in uncovered ones. *Myzus* (*Myzodes*) *persicae*, Sulz., was numerous in the first half of July, but was checked by rainy weather, an unidentified Hymenopterous parasite and the larvae of the Syrphid, *Sphaerophoria scripta*, L. Wireworms, of which *Drasterius bimaculatus*, Rossi, and *Hypnoidus* (*Cryptohypnus*) sp. were the commonest, were very injurious throughout May and June. Infestation was much more severe in plots planted early in May than in those planted later, and in plots mulched with fern than in those left uncovered. Noctuids, of which 80 per cent. were *Euxoa segetum*, Schiff., 11 per cent. *Agrotis* (*Rhyacia*) *ypsilon*, Hfn., and 9 per cent. *E. puta*, Hb., damaged 4–18 per cent. of the seedlings, but most of the injured plants recovered. Maximum activity was observed in June. *E. segetum* and *A. ypsilon* hibernated as mature larvae or pupae, and the adults were on the wing at the end of April, throughout July, and again from the beginning of August till late into autumn. The number of eggs laid by *E. segetum* varied from 1,284 to 2,246, and the duration of the egg stage averaged 5 days in summer. *A. ypsilon* laid 835–1,792 eggs, which hatched in 4 days at 23–25°C. [73·4–77°F.]. The larval stage of both species averaged 34 days, during 20–25 of which the larvae actually fed on tobacco. At 22–24°C. [71·6–75·2°F.], the prepupal stage of *E. segetum* lasted over 5 days and the pupal 14–17, the corresponding figures for *A. ypsilon* being 1–5 and 14–15. The prepupal stage of *E. puta* occupied about 40 days, pupation taking place in mid-August. Seedlings planted in the first half of June were much more severely infested than early planted tobacco. The rate of parasitism of the larvae did not exceed 8 per cent. The

following species were reared in cages containing both *E. segetum* and *A. ypsilon*: *Henicospilus repentinus*, Holmg., and *Peleteria nigricornis*, Mg., from the larvae of the second generation; *Amblyteles equitatorius*, Panz., and *Cnephalia bucephala*, Mg., from the pupae of the first; and *Wagneria nigrans*, Mg., from the larvae of the first and second generations, one individual being also obtained from a larva of *E. puta*. A larva of *Tabanus tergestinus*, Egg., found in the field in association with a dead cutworm, destroyed in the laboratory ten larvae in 25 days. Of the control measures tested, dusting with Paris green (road dust being used as carrier) was much more effective than the poison baits advocated by Crumb [*R.A.E.*, A, xviii, 36]. In July-August the larvae of *Laphygma exigua*, Hb., caused considerable damage to the foliage of tobacco plants, to which they migrated from *Amarantus retroflexus* after weeding. The flower buds and young fruits of tobacco were attacked by *Heliothis* (*Chloridea*) *obsoleta*, F., in August and September, about 40 per cent. of the plants being destroyed in one locality; in September many of the larvae were parasitised by *Anilastus* sp.

Insect pests of stored tobacco, which are dealt with in the second part, comprised 22 species, a list of which is given. Of these, *Lasioderma serricorne*, F., *Ephestia elutella*, Hb., and *Tenebroides mauritanicus*, L., were the most important. *L. serricorne*, which was only found in Sukhum, produced three generations during the year, hibernation occurring in the larval stage in cracks in the floor and walls, accumulations of dust, etc. In the samples of tobacco examined, 40–46 per cent. of the leaves bore traces of infestation, inferior qualities being more damaged than the better grades; about 2 per cent. of the leaf surface was usually destroyed. In a storehouse in September, the pupal stage lasted 10–11 days and the adults lived 27–31 days; oviposition began 4–5 days after emergence, females laying 39–45 eggs, which hatched in 5–6 days. *E. elutella* was present everywhere; the adults occurred from May till the end of October, being most numerous on 1st June, 24th July and 7th September. This Pyralid was kept in check by the parasite, *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.), which was particularly numerous in September. In some warehouses the Ichneumonid parasite, *Nemeritis canescens*, Grav., was also present. *E. elutella*, unlike *L. serricorne*, attacked the higher grades of tobacco, practically ignoring the inferior ones. *T. mauritanicus* decidedly preferred the lowest grade, the samples taken showing an infestation of 4·5 per cent.

Bostrychus capucinus, L., and *Ptilinus pectinicornis*, L., which infest wood, were present in all the storehouses examined, and in many instances the wood used in packing the tobacco was riddled by the larvae of *Lyctus* (*Trogoxylon*) *impressus*, Comolli.

For preventing infestation, the tobacco stores should be kept clean. Adults of *L. serricorne* may easily be caught on paper covered with an adhesive.

[Grünberg (B. M.).] **Гринберг (Б. М.). Dermestidae as Pests of Sericulture.** [*In Russian.*]—*Za Rekonstr. Shelkov.* [*Reconstr. Seric.*], no. 3–4 (16–17), pp. 127–147, 7 figs., 17 refs. Moscow, 1931. (With a Summary in French.) [Recd. December 1932.]

The literature on the damage caused by Dermestids in connection with the rearing of silkworms [*Bombyx mori*, L.] is briefly reviewed,

and the geographical distribution of the species that have been observed as pests in silkworm farms is discussed. Those found to cause serious injury in Central Asia are *Dermestes frischi*, Kug., which infests the cocoons, and *Trogoderma versicolor*, Creutz., which also attacks the eggs. All stages of these two species are described. Minor pests attacking the cocoons were *D. undulatus*, Brahm, *Attagenus piceus* var. *dalmatinus* Küst., and the Clerid, *Necrobia rufipes*, DeG.

In Tashkent *D. frischi* probably hibernates in the adult stage in places where the cocoons are dried. Pairing takes place early in April. The egg-stage lasts 2–3 days, the active larval stage about 6 weeks, and the prepupal and pupal stages about 2 and 1 week respectively. The larvae and adults prefer dark places and are found chiefly in the lower layers of the cocoons, and pupation usually occurs among them. The number of generations a year has not been ascertained, but there are probably two or three. The beetles are attracted to the cocoons that are being dried by the odour of those that contain dead and decomposing pupae. They oviposit from April till the end of September, and larvae are found from May till October. Beetles that emerged in the insectary in September and October at 20–24°C. [68–75·2°F.] did not oviposit, even after being fed, but survived the winter.

T. versicolor passes the winter as an active larva, but at 12–13°C. [53·6–55·4°F.] the larvae suspend feeding and become sluggish. The adults, which live about 20 days and apparently do not feed, are present from about the beginning of May till the autumn, ovipositing throughout this period, during which two generations are completed, the life-cycle requiring about 2 months, whereas the development of the overwintering generation covers a period of 7–8 months. The females sometimes oviposit on the bags containing eggs and ovipositing females of the silkworm, and the young larvae gnaw their way into the bags. The eggs do not develop in a humid environment, which may explain the absence of infestation in cocoons that are being dried. The larvae were not affected by exposure for 7–8 days to a temperature varying from 5 to 11°C. [41–51·8°F.] or by starvation for three weeks. As many as 60 may occur in a single cocoon of the silkworm. The pupal stage is passed inside the infested cocoons and lasts 5–7 days in summer, at 25°C., or 9–12 days in spring.

The life-cycle of *A. piceus* var. *dalmatinus* is probably completed in two years, as cocoons infested in 1928 gave rise to adult beetles at the end of May 1930.

Buildings used for keeping the eggs of the silkworms and for drying the cocoons should be clean, and the stored cocoons should be well aired. Inferior cocoons and those containing dead pupae should be removed and exposed in a thin layer to the sun. Pupae that are to be used for manuring the mulberry trees and to which *D. frischi* is readily attracted should be ground up for this purpose in March at the latest. Dry cocoons should be kept in metal boxes with well fitting lids.

The use of dry heat for killing pests of stored products is briefly reviewed from the literature. Exposure of infested cocoons to 58°C. [136·4°F.] killed all the larvae of *T. versicolor* in 12–15 minutes. This treatment should also be used for sacks in which the cocoons have been kept and to which the hairy Dermestid larvae cling. In fumigation experiments good results were obtained with chloropicrin at the rate of 17–20 oz. to 1,000 cu. ft. after exposure for 24 hours at a temperature of at least 20°C. [68°F.].

MENZEL (R.). **Beiträge zur Biologie und Bekämpfung von** *Cheimatobia brumata* **L.** [Contributions to the Biology and Control of *C. brumata*.]—*Rev. suisse Zool.*, xxxix, no. 2, pp. 271–273. Geneva, May 1932.

Notes are given on the bionomics of *Cheimatobia brumata*, L., in Switzerland, where it is one of the most injurious pests of fruit trees, and the usual measures are recommended for its control. A cold winter has little effect on its development, but many pupae are destroyed by a cold, wet summer, so that the moths are most numerous following a dry one.

VON GIERKE (E.). **Ueber die Häutungen und Entwickelungsgeschwindigkeit der Larven der Mehlmotte** *Ephestia kühniella* **Zeller.** [Moulting and Rate of Development in the Larva of *E. kühniella*.] —*Arch. EntwMech.*, cxxvii, no. 3, pp. 387–410, 16 figs., 8 refs. Berlin, 17th December 1932.

Larvae of *Ephestia kühniella*, Zell., reared in the laboratory, moulted either four or five times. At 25°C. [77°F.] the majority had five moults, whereas at 18°C. [64·4°F.] the majority had four. Each larval instar had a corresponding head size. At 18°C. the larvae that had moulted five times had larger heads than those that had undergone the same number of moults at 25°C., the difference already appearing in the early instars. In winter the time occupied by development increased, and there is evidently some factor connected with the season (apart from temperature) that affects its rate. The progeny, up to the fourth generation, of moths transferred from a temperature of 18°C. to one of 25° developed more quickly than those kept for many generations entirely at 25°. After a change from 25 to 18° development was slower than when the insects were maintained for several generations at 18°.

ANDERSEN (K. T.). **Reizphysiologisches Verhalten und Biologie der** *Sitona lineata*-**Larve.** [The physiological Behaviour towards Stimuli and Biology of the Larva of *S. lineata*.]—*Z. vergl. Physiol.*, xv, no. 4, pp. 749–783, 15 figs., 12 refs. Berlin, 1931.

Investigations on *Sitona lineata*, L. [*R.A.E.*, A, xix, 588] have been continued to supplement existing knowledge relating to its larva [*cf.* ii, 370 ; ix, 171]. The first part of this paper deals with the effect of gravity, light, moisture, and touch on the newly-hatched larva, and with its ability to perceive the nodules on leguminous roots into which it bores, and the second with the influence of humidity and temperature on its survival and activity in the period between hatching and boring into the root-nodule. The eyeless larvae did not respond to light by definitely directed movements, though erratic movements indicated their perception of strong light. They could recognise the presence of moisture and preferred a moist environment, but avoided water. They were more or less strongly geotactic and very strongly positively thigmotactic, endeavouring to occupy positions where they were touched on all sides. These factors of geotaxis and thigmotaxis suffice to keep them in the ground. They could detect the nodules on roots of beans at a distance of 2–3 yards, probably through a sense of smell.

With air saturated with moisture larval survival in the free period averaged 1½ days at 26° C. [78·8° F.] and 5½ days at 9°C. [48·2°F.]. It was shortened from days to a few hours immediately the relative

humidity dropped slightly below 100 per cent. This occurred at all temperatures investigated (9–26°C.) but was most marked at the higher ones. With a fall in atmospheric humidity to 90 per cent., all larvae died in 4–5 hours at temperatures above 15°C. [59°F.]. This implies that only those larvae survive that hatch during a period of rainy weather or at least in damp ground.

BLUNCK (H.) & MEYER (E.). **Erdflöhe.** [Flea-beetles.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 121, 4 pp., 1 fig. Berlin, November 1932.

With the exception of *Phyllotreta vittula*, Redt., which attacks grasses, Halticids of the genus *Phyllotreta* infest crucifers, *P. atra*, F., *P. nigripes*, F., *P. nemorum*, L., and *P. undulata*, Kutsch., being serious pests in Germany. *Haltica oleracea*, L., is often incorrectly stated to attack cabbage ; it lives on *Polygonum*, *Oenothera* and *Epilobium*. The rape flea-beetle, *Psylliodes chrysocephala*, L., is very injurious in the larval stage, boring into the stalks and leaf-stems of various crucifers. *Longitarsus parvulus*, Payk., and *Aphthona euphorbiae*, Schr., infest flax seedlings, and *Psylliodes attenuata*, Koch, attacks hops. Flea-beetles increase in hot, dry years, which are unfavourable to plant-life, and are particularly injurious to seedlings ; the usual measures are recommended for their control.

FEYTAUD (J.). **Un nouvel appât pour la destruction des courtilières.**—*Rev. Zool. agric. appl.*, xxxi, no. 7, pp. 105–107. Bordeaux, July 1932.

The bait of rice and barium fluosilicate recommended by Malenotti [*R.A.E.*, A, xx, 257, 726] against mole-crickets [*Gryllotalpa gryllotalpa*, L.] is described, and its cost in Italy and France is discussed.

FEYTAUD (J.). **Le pou de San José** (*Aspidiotus perniciosus* **Comst.**).—*Rev. Zool. agric. appl.*, xxxi, nos. 3, 4 & 6, pp. 33–40, 49–58, 89–100, 4 figs., 14 refs. Bordeaux, 1932.

In view of the interest recently displayed in *Aspidiotus perniciosus*, Comst. (San José scale) [*cf. R.A.E.*, A, xx, 506 ; xxi, 39, etc.], the author gives an account, taken from the literature, of the history, distribution, bionomics and appearance of this Coccid, its natural enemies and the artificial methods of controlling it. Recent legislation against its introduction into France [xxi, 39] is quoted in an appendix.

CARAMINI (M.). **Cocciniglie più communi e dannose agli alberi da frutta.** [The Coccids more common on, and injurious to, Fruit Trees.]—*Note Fruttic.*, x, no. 12, pp. 209–215, 3 figs. Pistoia, December 1932.

Notes are given on the bionomics and control of *Aulacaspis pentagona*, Targ., *Epidiaspis* (*Diaspis*) *leperii*, Sign. (*pyricola*, Del G.) and *Lecanium persicae*, F., which are the principal Coccids attacking fruit trees in Italy. *A. pentagona* has two generations a year in the north of the country and three in the south. *E. leperii*, which has two or three generations a year, has no efficient parasites and is resistant to many of the sprays commonly used against scale-insects, but may be controlled by tar distillates. *L. persicae* occurs only on peach and has one generation a year.

VOÛTE (A. D.). **Een nieuw geval van bestrijding van een insectenplaag met behulp van een inheemschen parasiet.** (*Ageniaspis* **sp., parasiet van** *Phyllocnistis citrella* **Staint.).** [A new Case of the Control of an Insect Pest by Means of an indigenous Parasite. (*Ageniaspis* sp., a Parasite of *P. citrella*).]—*Tijdschr. Ent.*, lxxv, Suppl., pp. 128–135, 2 graphs, 4 refs. Amsterdam, 1932.

Observations in Java on *Phyllocnistis citrella*, Staint., which mines in the very young leaves of *Citrus*, showed the egg, larval and pupal stages to last 4, 7, and 5 days, respectively, pupation occurring in a cocoon protected by the curled edge of the leaf. The indigenous Encyrtid, *Ageniaspis* sp., oviposited in the early stage larvae, but the latter were not killed until after they had prepared their pupal chambers. The pupal stage of the parasite appeared to require 16 days. The female parasitised all the larvae on a leaf and then passed to adjoining ones. Leaf-miner infestation occurred chiefly in newly prepared nurseries, being less severe in older ones and new seed-beds adjoining them. This was due to increased parasitism under shade, which was greater in the older plots as a result of the growth of the shade-trees. If some circumstance defoliated the latter, infestation at once increased on the citrus seedlings.

OUDEMANS (T. C.). **Kunnen Insectenplagen door de methode van boschaanleg voorkomen worden?** [Can Insect Outbreaks be prevented by the Method of Forest Lay-out ?]—*Tijdschr. Ent.*, lxxv, Suppl., pp. 223–228. Amsterdam, 1932.

The author recommends the planting of broad-leaved trees in pine stands in Holland so as to attract insectivorous birds and enable them to become established. They should then be of the utmost value in checking incipient insect outbreaks, whereas in the absence of such trees, flocks of birds that are attracted by large masses of insects only appear when the injury has already taken place.

PAOLI (G.). **Specie nuove di** *Empoasca* **(Hemiptera-Omoptera) e appunti di corologia.** [New Species of *Empoasca* and Notes on the Distribution and Food-plants of some Jassids.]—*Mem. Soc. ent. ital.*, xi, pp. 109–122, 6 figs. Genoa, 30th November 1932.

The new species described are *Empoasca distinguenda* on cotton in the Belgian Congo, and cotton, maize and beans (*Phaseolus*) in the Transvaal ; *E. benedettoi* on cotton in Italian Somaliland, the Anglo-Egyptian Sudan and Tanganyika ; *E. formosana* on an unnamed plant in Formosa ; and *E. decedens* on beans and beet in Italy.

A list shows the distribution and food-plants of a number of Jassids and includes records of infestation of cotton by *E. dolichi*, Paoli, in the Transvaal and Belgian Congo ; *E. facialis*, Jac., in Italian Somaliland, Tanganyika, Nigeria, the Belgian Congo and the Transvaal ; *E. decipiens*, Paoli, in Egypt ; and *Erythroneura lubiae*, China, in the Anglo-Egyptian Sudan and Italian Somaliland. Naudé records *E. facialis* as abundant on peas, cowpeas and ground-nuts in South Africa [*R.A.E.*, A, xviii, 528], but in the author's collection *E. dolichi* was abundant from these plants and *E. facialis* was rare and taken only from ground-nuts [*cf.* also xix, 731].

HOPKINS (J. C. F.). **Further Notes on Leaf Curl of Tobacco in Southern Rhodesia.**—*Rhod. Agric. J.*, xxix, no. 9, pp. 680–686, 1 pl., 5 refs. Salisbury, Rhodesia, September 1932.

Consequent upon Storey's observations on leaf-curl of tobacco in Southern Rhodesia [*R.A.E.*, A, xx, 330], the author describes experiments in which Aleurodids were tested as vectors of the disease. The results showed that leaf curl of tobacco in Rhodesia appears to be identical with that occurring in Tanganyika [*loc. cit.*], being due to a virus that is transmitted from plant to plant by Aleurodids. The control measures consist essentially in removing all sources of infection immediately after harvesting [see next paper], so that there is no reservoir for the whiteflies to feed upon at the beginning of the following season, as well as removing all infected plants that appear in the crop. The experiments described have shown that about 25 Aleurodids is the minimum number required to each plant to obtain a high percentage of transmission of the disease.

MOSSOP (M. C.). **Cultural Methods and Tobacco Whitefly in Southern Rhodesia.**—*Rhod. Agric. J.*, xxix, no. 11, pp. 869–872. Also as *Bull.* [*Minist. Agric. Lds. S. Rhod.*] no. 868, 4 pp. Salisbury, Rhodesia, November 1932.

In order to determine the importance of tobacco plants as winter quarters and centres of infestation of the Aleurodids carrying leaf-curl of tobacco [see preceding paper], a visit was made in September 1932 to one of the large tobacco-growing areas in Salisbury that had been inspected in the previous season. On a few farms no effort had been made to remove the previous season's plants, and both whiteflies and the disease were present to some extent. On lands where the plants had been cut off below the soil and left, more than 50 per cent. of regrowth was found, and both whiteflies and leaf-curl were discovered. Even on lands that had been ploughed, a few plants appeared ; these were to some extent diseased, though whiteflies were not always found on them. In sheltered places, such as against walls of buildings, more vigorous plants were found than those in the open fields ; some of these harboured whiteflies in large numbers in all stages of development and also leaf-curl, and it is thought that these plants form the breeding-places throughout the winter of the insect vectors, which gradually increase in numbers from August until the middle of October, when they are quite abundant, though they may still be scarce in the fields. Leaf-curl has been found to persist in a given plant throughout the winter, and roots of a diseased plant from which the stalks have been cut below ground can give rise to suckers with obvious signs of the disease in the absence of whitefly. Old diseased plants may not necessarily retain symptoms of the disease, though the plant remains infected and may show the symptoms when it throws out suckers. The insect known in Rhodesia as the tobacco whitefly is thought to be a species of *Bemisia*. It has also been found to breed on cotton, tomato, *Vernonia* sp., sowthistle (*Sonchus oleraceus*) and pigweed (*Amarantus graecizans*), and there are almost certainly other food-plants. *Ageratum* is suspected of harbouring both the insect and the disease. The common whitefly (another species), which has not been found on tobacco in the field, has been reared from egg to adult on tobacco in Salisbury and has been known to breed on several other plants. It is parasitised by a species of *Prospaltella*, which may be found to attack the tobacco whitefly.

These studies confirm the necessity for thorough cultural practices to ensure the eradication of tobacco plants after harvest. Besides the normal routine of pulling out and burning the plants as soon as the crop is harvested and following this by ploughing, stumps and roots that may be left should be removed, and this should be continued fortnightly or monthly, the plants generally revealing their presence by sending up suckers. All tobacco plants in the vicinity, especially those in sheltered places, should be sought out and destroyed, and seed beds in use should be covered with tobacco cloth. It is suggested that if the presence of the insect is suspected, one part (by volume) of 6–8 per cent. tobacco extract should be added to every 80 parts of Bordeaux mixture used on the seedbeds. Weeds should be kept down, including not only those known to be attacked by the whitefly but others, which may harbour the insect and the disease.

MARSHALL (Sir G. A. K.). **New Curculionidae (Col.) from the Belgian Congo.**—*Ann. Mag. Nat. Hist.*, (10) xi, no. 61, pp. 1–16. London, January 1933.

Among the new weevils described from the Belgian Congo are: *Palaeocorynus sellatus*, feeding on the leaves of coffee; *Himatinum coffeae*, bred from larvae in coffee berries; and *Leurostenus* (gen. n.) *elaeidis* and *L. filum*, both found in dried petioles of oil palm (*Elaeis guineënsis*). *L. elaeidis* is also recorded from Sierra Leone.

DE LÉPINEY (J.) & MIMEUR (J. M.). **Les parasites du *Myoporum* dans la région de Rabat.**—*Bull. Soc. Sci. nat. Maroc*, xi, no. 7–8, pp. 137–140. Rabat, 1932.

Species of *Myoporum*, and in particular *M. insulare*, which is a favourite shade and ornamental tree in the gardens and parks of the coast of Morocco, are frequently killed as a result of insect infestations. A study of the insect fauna has shown that the mealybug, *Pseudococcus adonidum*, L., is the chief cause of injury, colonies developing on the aerial parts of the plant as well as on the roots where they are more or less exposed. There are several generations a year. Neither indigenous Hymenopterous parasites nor the introduced Coccinellid, *Cryptolaemus montrouzieri*, Muls., has succeeded in preventing the irregular but continuous spread of this insect on the Moroccan coast. A number of minor pests have been observed on the trees, including another Coccid, *Aspidiotus lataniae*, Sign., which has been found occasionally on the older branches, but chiefly congregated on the deeper parts of the roots.

MEYRICK (E.). **Exotic Microlepidoptera, iv, pt. 11.**—pp. 321–352. Marlborough, Wilts, the author, December 1932. Price 3*s.* per part.

Among the new species described are the Pyralids, *Balanotis leucatma*, bred in October from larvae feeding on leaves of mango (*Mangifera indica*) in Ceylon, and *Diatraea polychrysa*, most of the larvae of which were found feeding in stems of rice, a few in maize and one in *Scirpus grossus*, in Malaya.

BETREM (J. G.). **Voorloopige resultaten van de takkenboeboek-bestrijding door middel van takkenboeboeksmeer.** [Preliminary Results of Coffee Twig-borer Control by Means of Twig-borer Grease.]—*De Bergcultures*, vi, no. 42 (pp. 1115 *et sqq.*), reprint pp. 1–18, 1 fig., 6 graphs. Batavia, 1932.

BETREM (J. G.) & GRANDRUP (J.). **Het nut van de verwijderen van aangetaste takken.** [The Value of Removing infested Coffee Twigs.]—*T.c.*, reprint pp. 18–29.

The first paper describes experiments, including one already noticed [*R.A.E.*, A, xx, 163], made in Java to test the value against coffee twig-borers [*Xyleborus* spp.] of smearing the twigs of young plants with various greases. The treatment reduced the amount of infestation and, in general, the loss of twigs, though increased death of twigs occurred on weak bushes. The growth of the bushes in the treated plots was more uniform, and their condition and yield was improved. The uniform growth, however, was attended by the disadvantage that it was difficult to recognise bushes susceptible to infestation, so that their removal from the plots was delayed. The upper side of a twig should not be smeared, an excess of material should be avoided, and application should not be made immediately before the dry season.

The second paper discusses the value of the removal of infested twigs. It is concluded that control by this measure is theoretically possible, but as many of them are capable of recovery from attack, their removal represents a loss.

SMITH (J. H.). **The Tobacco Stem Borer.**—*Queensland Agric. J.*, xxxviii, pt. 4, pp. 331–337, 3 figs. Brisbane, 1st October 1932.

Phthorimaea heliopa, Lw. (tobacco stem-borer) was first recorded in Queensland as a pest of tobacco in 1931, when it caused considerable damage to seedlings, and it appears that in some districts at least it may be the chief factor preventing the successful cultivation of tobacco. Its resemblance to *P. operculella*, Zell. (tobacco leaf-miner), and the fact that the two moths occur in association, may account for its not having been recognised in the past. Both species have been reared from the stems of plants that have collapsed in the field. In general such losses may be assigned to *P. operculella* if the burrows are near the surface of the stem, and to *P. heliopa* if there is core injury.

Some of the information on its bionomics is similar to that already noticed [*R.A.E.*, A, xviii, 159]. The eggs, which are laid over a period of about 3 weeks, hatch in about 7 days in summer. The larvae feed for about 4 weeks, several occurring together in one plant. The total life-cycle occupies about 6 weeks. Injury to the seedlings, which is first evidenced as malformation of the tip, results in the throwing out of secondary suckers from the axils of the leaves below the swelling in the stem and necessitates considerable pruning. Though a crop may ultimately be obtained, it rarely has the uniformity that is considered desirable. Infestation may occur without any visible effect on the plants if they are firmly established, but it permits the entry of saprophytic fungi, which may rapidly invade the healthy tissues of the stem and subsequently cause the general collapse of the plant. The fact that infestation of the pith is most common in transplanted plants amongst an already heavily infested crop suggests that resistance to new attack increases with age.

Where the growing point is affected, the plant may be cut back to a sucker in the axil of a lower leaf, which will then function as the tip of the plant. The discarded tips should in all cases be collected and destroyed. Seedlings may be protected from Lepidopterous pests in years of heavy infestation by covering them with a layer of stockinette or mosquito-netting, which is supported by boards placed on edge around the seed beds. One end of the material should be fastened down and the other attached to a running pole to take up the slack. The plants may be watered through this covering. The hessian covers in general use as shelter against storms provide additional protection when necessary. Unnecessary breeding material may be eliminated by uprooting all plants in a cultivated area as soon as practicable after harvest. They will dry out rapidly if exposed to the sun, and the younger larvae contained in them will be unable to complete their development.

Nicholls (H. M.). **The Bee-louse.**—*Tasmanian J. Agric.*, iii, no. 4, pp. 163–165, 1 fig. Tasmania, 1st November 1932.

A brief account is given of the characters, systematic position, bionomics and control of *Braula coeca*, Nitz. (bee-louse), which was probably introduced on queen bees from Italy to Tasmania, where it is now widely distributed. It is reported that good results in control have been obtained by opening the infested hives in the evening and sprinkling or spraying the bees with very dilute honey, which induces them to clean themselves, the flies being dislodged during the process. They should then be collected and burnt.

Carter (W.). **The Spotting of Pineapple Leaves caused by *Pseudococcus brevipes* (Ckl.), the Pineapple Mealybug. (Abstract.)**—*Phytopathology*, xx, no. 12, p. 996. Lancaster, Pa., December 1932.

Under field conditions in Hawaii two general types of spotting of pineapple leaves result from the feeding of *Pseudococcus brevipes*, Ckll., the typical chlorotic area following attack by Coccids and a green spotting, the latter being caused by the feeding of certain individuals only. Some colonies have been maintained for a year without any green spots resulting, whereas others have consistently produced these symptoms. One colony was apparently inherently capable of producing green spots, for these appeared at rare intervals. Attempts to transmit the symptoms either by mechanical means or by transfer of mealybugs that did not cause them to healthy leaves after they had fed on green spotted tissue were unsuccessful. The ability to produce the spots is hereditary, a fact that leads to a consideration of the possible relationship between the intracellular symbionts of the insect and its secretions. The individuals that produce the green spots can often be distinguished by a difference in colour, the dark brown of the body fluids imparting a greyish colour to the waxy covering.

Carter (W.). **The Pineapple Mealybug (*Pseudococcus brevipes* (Ckl.)) and Wilt of Pineapples. (Abstract.)**—*Phytopathology*, xx, no. 12, pp. 996–997. Lancaster, Pa., December 1932.

Wilt of pineapple caused by *Pseudococcus brevipes*, Ckll., which is the most serious cause of destruction of these fruits in Hawaii [*cf. R.A.E.*,

A, xix, 676], assumes various forms. Quick wilt develops after a sudden attack by a fairly large colony of mealybugs, which may, however, feed for only a short time. Slow wilt is the result of a continuous attack by a gradually increasing population, its incidence being governed by the size of the colony and the length of time it feeds on the plant. The disease is believed to be due to the secretion by the insect of a non-living but toxic principle [*cf. loc. cit.*] that is variably diffusible, sometimes affecting only the area of leaf on which the mealybugs feed, and sometimes producing wilt in two or three contiguous leaves, or, as is usually the case in the field, a wilted condition of the whole plant. Comparison of quick and slow wilts suggests an antitoxic reaction by the plant, which enables it to accommodate itself to large, but gradually developed, populations of the mealybug. The toxicity of *P. brevipes* appears to vary with the kind and condition of its food-plant.

FRANSSEN (C. J. H.). **De wrattige maïsboorder** (*Pyrausta nubilalis* **Hbn.).** [The Maize-borer, *P. nubilalis*.]—*Landbouw*, viii, no. 4, pp. 266–284, 3 figs., 8 refs. Buitenzorg, October 1932. (With a Summary in English.)

The following is taken from the author's summary : The species of *Pyrausta* observed in Java, Sumatra and Borneo must be considered identical with *P. nubilalis*, Hb., the common European maize-borer. The form in Celebes and the Saleier islands, described by Snellen as *P. salentialis*, appears to be only a subspecies of *P. nubilalis*, differing only in some details of biology. Biological observations were made at Sengkang (Celebes) and Buitenzorg (Java), and the data obtained are set out in tables. On maize the eggs are laid by night on the undersides and near the tips of the three upper leaves of plants in the early tasselling stage or somewhat later. The larvae feed for a short time in the epidermis of the undersides of the leaves and then move to the tassels, where they live gregariously, spinning the flowers together. Sometimes they bore into the ribs of the leaves. When half-grown they bore into the upper part of the stalk immediately above a node and burrow for a short time upwards ; coming out, they re-enter the stalk near a lower node. This continues until the larvae, which moult five times, are full-grown. In Java, but not in Celebes, the larva sometimes bores right through the node. If the larvae attack the stalk at a lower level, the cob cannot mature. In Celebes *P. nubilalis* is exclusively a stalk borer ; in Java and Sumatra it is also a cob-borer. Other food-plants in Java are *Sorghum* and *Blumea lacera*. About 59 per cent. of the moths in Java and 68 in Celebes were females. No egg-parasites were obtained. In Java a species of *Chelonus* oviposited in the eggs, the larva developing in that of the host and emerging when the latter reached the fourth instar. In Celebes the larvae were attacked by a Tachinid and an unidentified Hymenopterous parasite, and *Xanthopimpla modesta*, Smith, was bred from the pupae. *P. nubilalis* is of little importance in the Netherlands Indies ; only two outbreaks on maize in Java have come to the author's notice.

DAVIDSON (J.). **Insects observed on Crops in South Australia during the Period June, 1930, to June, 1932.**—*J. Dept. Agric. S. Aust.*, xxxvi, no. 3, pp. 283–286, 1 ref. Adelaide, October 1932.

Self-sown barley was found to be attacked by *Cirphis unipuncta*, Haw., in one locality ; the infestation failed to spread, however, to an

adjacent cereal crop. Lucerne was damaged by *Smynthurus viridis*, L., which during 1932 was generally active a month earlier than usual owing to early autumn rains [*cf. R.A.E.*, A, xx, 400, etc.], *Isotomurus palustris*, Müll., and *Katianna australis*, Wmr., which were present in small numbers, *Halotydaeus destructor*, Tuck., and *Penthaleus bicolor*, Frogg. *Phthorimaea operculella*, Zell., occurred on tomatos in glasshouses, *Nysius vinitor*, Bergr., on linseed, turnips, parsnips, carrots and potatoes, and *Dindymus versicolor*, H.-S., in very large numbers, on vegetables, chiefly potato. Numerous larvae of *Phorbia* (*Chortophila*) *florilega*, Zett., were found in hollowed out, decaying bulbs of young onion plants ; this fly could not be induced to oviposit on the plants and possibly only occurs in onions injured by some other cause. Other pests included *Hippotion celerio*, L. (silver striped vine moth) ; *Tortrix* (*Cacoecia*) *postvittana*, Wlk., on bunches of grapes ; *Diphucephala colaspidoides*, Gyll., which caused injury to fruit trees, chiefly plum ; *Otiorrhynchus cribricollis*, Gyll., on young *Citrus* ; *Thrips imaginis*, Bagn., which was very numerous in the spring of 1931 and caused severe injury to late flowering varieties of apple, being also prevalent on small fruits and vine ; *Myzus persicae*, Sulz., on peach ; *Eriophyes pyri*, Pgst., on pear ; *Monopis ethelella*, Newm., on soiled portions of stored fleeces ; and *Chermes* (*Pineus*) *pini*, L., on *Pinus insignis*.

Muggeridge (J.). **Entomology Section.**—*Ann. Rep. Dept. Agric. N.Z. 1931–32*, pp. 44–46. Wellington, N.Z., 1932.

A brief survey of the position as regards *Pieris rapae*, L. (cabbage white butterfly) in New Zealand [*R.A.E.*, A, xxi, 13, etc.] revealed that in Hawke's Bay most of the damage to cruciferous crops was caused by *Plutella maculipennis*, Curt. It does not follow, however, that *P. rapae* will not become a serious pest, as it is only within the next 1–2 years that the full effect of its presence will be felt. *Phthorimaea* (*Gnorimoschema*) *melanoplintha*, Meyr. (tomato stem-borer), which was believed to be an indigenous species, is now known to have been introduced into the country, probably from Peru. It is similar to, if not identical with, *Phthorimaea plaesiosema*, Turn., which bores in stems of tomato in Australia. Investigations on the life-history of red mites in the fruit-growing areas of New Zealand have revealed the presence of two species, *Paratetranychus pilosus*, C. & F., and *Bryobia praetiosa*, Koch, the former being the more important. Its life-cycle from egg to adult occupies 10–14 days, and the overwintering eggs are laid as early as February over a comparatively short period. Comparatively low percentages of mortality were obtained in laboratory experiments against the winter eggs of these mites with nine types of commercial oils applied as dormant sprays at strengths of 1 : 15 and 1 : 20. The experiments indicate that the viscosity of an oil is one of the main factors determining its ovicidal value, oils having viscosities of 127, 59 and 31 giving 60, 25 and 10 per cent. control of the eggs, respectively. Laboratory experiments showed summer oils to be superior to lime-sulphur for use against mites in that they are effective against all stages and at a strength of 1 : 80 gave up to 100 per cent. control of the summer eggs, which were unaffected by lime-sulphur at a strength of 1 : 40. Furthermore, unlike lime-sulphur, they are compatible with other sprays.

Studies are being carried out in the field and laboratory with commercial brands of acid and basic lead arsenate and calcium arsenate,

to discover the most efficient spray for use against chewing-insects, as determined by their relative toxicity and sticking and spreading qualities. Laboratory tests have so far been confined to the examination of the relative toxicity of several series of equal quantities of the three arsenicals, the amounts used in each series being correlated with those commonly applied in the orchard, to discover the minimum quantity effective against various insects and whether they can be improved by the addition of adhesives and spreaders. Tests proved that the usual quantities of arsenate employed in orchard practice are effective in the control of *Eucolaspis brunnea*, F. (bronze beetle) provided that they adhere evenly to the fruit. Apples dipped in a mixture of 2 lb. acid lead arsenate, 1 lb. casein spreader and 100 gals. water for 1–2 minutes until an even cover was obtained were not attacked, whereas apples dipped in a mixture of 4 lb. acid lead arsenate to 100 gals. water for the same length of time were badly damaged, the spray cover being patchy and the beetles feeding on the untouched areas. Experiments also showed that oils, which are natural spreaders and give a better cover than arsenicals alone, are repellent to *E. brunnea*, and investigations will be undertaken to find an oil that will combine satisfactorily with the arsenate and cover the fruit evenly. Small scale laboratory experiments indicated that sufficient poison is applied in orchard practice to kill leaf-rolling caterpillars if the sprays are properly timed. In the field, calcium arsenate caused severe injury to fruit and foliage.

An investigation of the seasonal history of *Cydia* (*Laspeyresia*) *pomonella*, L., on apples, showed that a calyx spray is generally unnecessary and that seasons in which it is required may be determined by the use of bait traps, the spray being applied within 10 days of the appearance of the first moth. The calyx infestation in 1931–32 was found to be small, and few moths were observed by the end of February.

MICKEL (C. E.). **Armyworms in southern Minnesota.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1123–1128, 1 fig. Geneva, N.Y., December 1932.

Outbreaks of *Loxostege commixtalis*, Wlk. (alfalfa webworm), *Meliana* (*Neleucania*) *albilinea*, Hb. (wheat head armyworm), *Agrotis c-nigrum*, L. (spotted cutworm) and *Cirphis unipuncta*, Haw., occurred during June and July 1932 in southern Minnesota. Severe injury by *L. commixtalis* was reported on 16th June, when the larvae were practically full-grown and had migrated from pasture land to maize, barley, clover and lucerne, but the infestation was limited to a few widely scattered localities. It is probable that larvae of a second brood developed in August, though their numbers were so reduced as to escape general notice. The larvae may be controlled when migrating by ploughing a furrow across their line of advance and placing in it a bait consisting of 50 lb. bran, 2 lb. Paris green, 1 U.S. gal. molasses and 2–3 U.S. gals. water. If they are already established on a crop, the bait may be broadcast over the infested area in very small portions. The larvae of *M. albilinea* occasionally appear in fields of timothy [*Phleum pratense*] and do considerable injury to the heads of the growing grass. The last general outbreak of this moth occurred in 1910, and the infestation recorded in 1932 was purely local. Poison bran mash is apparently ineffective in controlling the larvae, and in case of bad infestation the crop should be harvested in order to save it.

A general outbreak of *A. c-nigrum* was reported from 4 counties during the second half of July. As the first-brood larvae of this moth are said to appear very early in the spring and to pupate before 1st June, it is concluded that this infestation was due to those of a second brood. The larvae assumed the migratory habit when their food-supply became exhausted and caused serious injury to barley, wheat, potatoes, onions, flax and maize. Poison bran mash proved very effective in control.

In all outbreaks of *C. unipuncta* in southern Minnesota, where they occur periodically at intervals of 3–5 years, the armyworms have first appeared on winter rye grown on peat soil, which is particularly attractive to the ovipositing moths, and later migrated to other crops. General field observations indicate that the larvae hatch in the autumn, hibernate, and resume feeding in the spring. Injury to rye becomes noticeable about the middle of June. As this crop ripens, the armyworms move to adjacent fields in search of more succulent food. During a serious outbreak, the numerous natural enemies of *C. unipuncta* destroy so many of the larvae that several years are required for it to increase again to injurious numbers. The outbreak of 1932 was part of a general one occurring also in Iowa and is unlikely to continue in 1933. Elimination of winter rye as a crop on peat soil, pasturing winter rye in autumn and spring, close observation of rye fields in May and June to discover the presence of infestation and the use of poison bran mash are suggested as control measures when a serious attack is imminent.

PEPPER (J. H.). **Catalase Activity in Army Cutworm Moths** (*Chorizagrotis auxiliaris* **Grote**).—*J. Econ. Ent.*, xxv, no. 6, pp. 1128–1133, 2 figs., 7 refs. Geneva, N.Y., December 1932.

Recent investigations have indicated that the enzyme, catalase, is an important factor in physiological processes. An experiment was carried out in Montana to determine the relationship between catalase content and physiological activity of *Chorizagrotis auxiliaris*, Grote, prior to, during and following the period of aestivation. The life-history of this moth, as described by several authors, is briefly outlined. The adults begin to emerge after the third week in June and are active until high temperatures cause them to enter aestivation. According to one author [*R.A.E.*, A, xvii, 97], the length of the period of aestivation, which precedes oviposition, depends entirely on seasonal temperature [*cf.* also xxi, 49]. The apparatus used and the technique employed in making the catalase determinations are described. Comparative data are presented on the catalase content of females of the grasshopper, *Melanoplus bivittatus*, Say.

A relationship was found to exist between egg development and catalase activity in *C. auxiliaris*. When no sign of egg development was noted, catalase activity was low, but as development progressed catalase activity also increased until well into the egg-laying period, when it dropped off sharply. Although this at first appeared to be correlated with the stage of development of the eggs, determinations made in the males were afterwards found to follow the same general trend. In the case of *M. bivittatus* the catalase content showed a gradual decline, even though egg development progressed throughout this period. In general the period of low catalase activity seems to correspond with that of aestivation noted by previous workers.

Worthley (H. N.). **Chemically treated Codling Moth Bands in Pennsylvania.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1133–1143, 9 refs. Geneva, N.Y., December 1932.

Studies of the use of treated bands on apple trees for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., carried out in Pennsylvania from 1928 to 1931, showed that bands of corrugated straw board, properly impregnated with a mixture of 1 lb. beta-naphthol in 1·5 U.S. pints red engine oil, will prevent at least 95 per cent. of the expected emergence of moths of the first summer generation from larvae in them. The toxicity of the bands, which seemed to vary with the amounts of chemicals deposited on and persisting in them, was maintained throughout the season, preventing a considerable proportion of the emergence of moths from overwintered larvae. Narrow (2 in.) bands were as toxic as wide (4 in.) ones.

In tests carried out in 1931, a wide half-band was applied to the eastern side of the tree trunk and a narrow half-band of the same type to the west side, the two halves meeting on a north-south line. On alternate trees the position of the two half-bands was reversed. Overcrowding in narrow half-bands, rather than too much light in the tunnels, seemed to cause the larvae to seek the wide half-bands. No preference for wide bands appeared except in heavily infested orchards.

The proportion of the total population of cocooning larvae trapped under bands, which was shown in an investigation carried out in 1930 and 1931 to vary from 73 to 96·84 per cent., appears to be determined by the extent to which other attractive hibernating quarters can be removed from the trees. The cost of scraping and banding mature trees, estimated from somewhat inadequate figures, is about 19*s*. [at par] per acre, but this might be reduced by the development of an effective band containing a smaller amount of a more adhesive chemical mixture.

Balch (R. E.). **The Fir Tussock Moth** (*Hemerocampa pseudotsugata* **McD.**).—*J. Econ. Ent.*, xxv, no. 6, pp. 1143–1148, 4 refs. Geneva, N.Y., December 1932.

Practically simultaneous outbreaks of *Hemerocampa pseudotsugata*, McD. (fir tussock moth), which was first observed in British Columbia in 1918, when it was identified as *H. vetusta gulosa*, Hy. Edw. [*R.A.E.*, A, ix, 321, etc.], have occurred in widely separated areas there and in the western United States as far south as Nevada during recent years. Considerable damage has been caused in fir forests. *H. leucostigma*, S. & A., which previously had been known only as a pest of deciduous trees, was found in 1930 attacking *Abies balsamea* in Nova Scotia. All stages of *H. pseudotsugata* are described. The eggs, which are laid in masses, hatch late in May or early in June. The larvae are very active and crawl considerable distances in search of foliage. Pupation begins early in August, and the adults emerge about two weeks later, the males somewhat earlier than the females. Mating and oviposition follow closely after emergence. The wingless female is very inactive and almost invariably lays its eggs on its cocoon.

The larvae feed on both old and new foliage of fir. The earlier instars eat out the under side of the needle, consuming less than half the tissue and leaving the resin ducts untouched. In the later instars, the whole of the needle is attacked, though it may be chewed through at the base and destroyed without being consumed. Owing apparently

to negative geotropism of the larvae, the upper third of the crown is always defoliated first, but in heavy infestations the trees are completely stripped. Douglas fir (*Pseudotsuga taxifolia*) and *Abies grandis* are the preferred food-plants, but *Abies lasiocarpa* has also been found to foster outbreaks, and other conifers, including pines (*Pinus flexilis* and *P. ponderosa*), are attacked in mixed stands. Local differences in host preference were observed. In one instance the undergrowth, which consisted of *Pachystima myrsintes*, was defoliated while the firs were only slightly attacked, the reverse being the case at points 10 miles away. The extent of the damage caused in Nevada, Idaho and Washington between 1927 and 1930 is discussed, together with its possible effect on the stands.

Although no close study of natural control was made, observations on 10th August 1929 in Idaho indicated that many larvae had died from disease and starvation. Of 300 cocoons examined in October, 85 per cent. had been parasitised, 4 per cent. contained dead pupae, 5 per cent. had produced male moths and 6 per cent. females. The most important parasite was a Tachinid. The following parasites, of which the first three destroy the eggs, were bred from *H. pseudotsugata* in 1929: *Trichogramma minutum*, Riley, *Telenomus coelodasidis*, Ashm., *T. californicus*, Ashm., *Pimpla* (*Ephialtes*) *sanguineipes*, Cress., *Conoblasta fumiferanae*, Vier., *Theronia fulvescens*, Cress., and *Hyposoter pallipes*, Prov.

Although, as the females are wingless, it was thought that the spread of *H. pseudotsugata* would be slow and incipient outbreaks easy to eradicate, foci of infestation discovered in 1928 were found in 1929 to extend over large areas. It is possible that the larvae spread rapidly. The first instar can be carried long distances by even a light wind, and in the final stage the larvae are capable of travelling 60 ft. over rough ground in less than an hour. Under certain circumstances where small centres of infestation do not appear to spread rapidly, it may be possible to apply direct control measures with success, clear cutting followed by burning being considered the best.

McAlister (L. C.) & Anderson (W. H.). **The Blueberry Stem-Gall in Maine.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1165–1169, 1 pl., 5 refs. Geneva, N.Y., December 1932.

Hemadas nubilipennis, Ashm., which appears to be distributed throughout the blueberry growing area in Maine, was the only one of 5 Chalcidoids reared from galls formed during the summer of 1930 and collected from the stems of low-bush blueberry plants (*Vaccinium augustifolium* and *V. canadense*) during April 1931 found to be capable of producing the galls [*cf.* *R.A.E.*, A, xvii, 83]. The female lays 12–15 eggs, which hatch in 10–15 days, although 20 days elapse before any swelling of the blueberry stem is noticeable. Tests in which unmated females were placed on caged blueberry plants indicate that reproduction does not occur parthenogenetically. Hibernation seems to take place in the mature larval stage within the gall, each larva in a separate cell. When the galls are very numerous, the injury may be severe through reduction in the fruiting surfaces of the plants [xvii, 33], but the practice of burning over the blueberry fields in rotation every second or third year keeps this Pteromalid in check, and it is at present of very little economic importance as a pest of blueberry in Maine.

Knowlton (G. F.). **Jointworm Studies in Utah.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1169–1172, 1 fig. Geneva, N. Y., December 1932.

The following is almost entirely taken from the author's abstract: Infestation of dry-farm wheat in Utah by the second brood of *Harmolita grandis*, Riley (wheat strawworm) was considerably lower during 1931, and that of irrigated wheat but slightly reduced, as compared with conditions during the preceding year. During 1931 *H. tritici*, Fitch (wheat jointworm) was found infesting wheat in three areas. *H. websteri*, How. (rye strawworm) is frequently encountered in rye-growing areas of northern Utah, where it is more generally distributed than *H. secalis*, Fitch (rye jointworm). The latter, although scarce in 1930 and 1931, is a potential pest where rye is grown year after year over large areas.

Summerland (S. A.). **The Tile-horned *Prionus* as a Pest of Apple Trees.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1172–1176, 13 refs. Geneva, N.Y., December 1932.

Prionus imbricornis, L., which from time to time has been recorded as attacking a variety of plants, has recently caused severe injury to apple trees in Arkansas. A related beetle, *P. californicus*, Motsch., has been recorded as a very serious pest of apple in New Mexico [*R.A.E.*, A, xvi, 681]. Inspection of one orchard in the Ozark district indicated a 100 per cent. infestation with several larvae to each tree, many trees being killed outright. Infested trees that were not killed failed to yield to maximum capacity. Bearing trees killed by *P. imbricornis* cannot be safely replaced, as many of the replants would be destroyed the first year and very few would reach bearing age without being attacked. Examination of 6 young trees set out in the autumn and found to be dead the following year showed that they had been eaten off about 1 inch below the surface and that the entire root system was missing. Young trees that have become fairly established usually have one or two small roots left near the surface of the soil, which keep them alive until wind or accident cause them to fall over. The borers either girdle and kill the roots by working on the surface or honeycomb them from within. Both types of injury are often found in the same root. In the case of old trees the roots on one side may be badly injured, causing only one side of the tree to die; where the attack is more uniform, the tree becomes gradually weaker until it dies.

In rearing experiments tin salve boxes were partly filled with soil and kept in watertight containers filled with sand, the containers themselves being buried in the soil. The incubation period in 1931 varied from 18–31 days at a mean soil temperature of 73·3°F. to 29–36 days at 69·8°F. The length of the larval period is not known, though some authors suppose it to be about 3 years. In experiments in which the larvae had to descend 6 inches into the soil in search of food, 60 per cent. found the apple roots and established themselves when they had to move laterally 6 inches and 31·7 per cent. when they had to move 12 inches to do so. There is apparently a small amount of cannibalism among the larvae. Very little mortality occurred among larvae less than a year old when submerged in water for 17 days, and older larvae soon revived after being submerged in water that was allowed to freeze. Observed cases of pupation all took place in the soil, although it has been stated that it may occur in the wood also. The adults emerge

in July over a relatively short period and disappear in a few weeks. The females although winged do not appear to fly, but the males fly readily.

Complete oviposition records, which were secured only for two females, showed that eggs were laid from 2nd to 19th August, the number being 450 and 569 respectively. The oviposition period lasted 8–15 days, the greatest number of eggs laid in 24 hours being 105 and 161 respectively, and each female lived 3 days after ceasing to lay eggs. Eggs are deposited in the soil without apparent regard to the position of the food-plant. Observations in the soil after ovipositing females had been caged around an apple tree showed no eggs within 4 inches of the tree, the majority being at a distance of 12–18 inches from it.

Richardson (C. H.) & Glover (L. H.). **Some Effects of certain "Inert" and Toxic Substances upon the Twelve-spotted Cucumber Beetle,** *Diabrotica duodecimpunctata* (**Fab.**).—*J. Econ. Ent.*, xxv, no. 6, pp. 1176–1181, 1 graph, 6 refs. Geneva, N.Y., December 1932.

The following is the authors' abstract: Adults of *Diabrotica duodecimpunctata*, F., were heavily dusted with a number of pulverised substances. The effectiveness of the materials, based upon the time taken to kill 50 per cent. of the beetles, followed in the order: Sodium fluosilicate = calcium arsenate > acid lead arsenate > commercial calcium hydroxide = kaolin > gypsum > bentonite. Beyond the points of 50 per cent. mortality, the survival curves of calcium hydroxide and of kaolin diverge widely, indicating a greater effectiveness, under these conditions, for the former substance. Examinations of the digestive tracts of dusted beetles before or after death showed that in most instances the ingested bentonite, gypsum, kaolin or calcium hydroxide had passed into the posterior half of the tract. The presence of the more active arsenicals and sodium fluosilicate was not detected in the gross examinations of the digestive tract.

Gaines (J. C.). **Studies on the Progress of Boll Weevil Infestation at various Distances from Hibernation Quarters.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1181–1187, 2 graphs, 1 fig., 1 ref. Geneva, N.Y., December 1932.

The relation between the progress of infestation by *Anthonomus grandis*, Boh., in cotton at various distances away from the hibernation quarters and the flight of the weevils was determined by a study, carried out in Texas in 1930 and 1931, of the degree of infestation and screen trap collections. The degree of movement from field to field was indicated by traps situated in fields adjacent, but not planted with cotton. In 1930, daily visits were made from 12th July to 17th November to 20 screen traps installed in and between cotton fields to record the catch of weevils. Records were also made of the infestation and condition of the cotton during the growing season. It was found that extensive migration began about 15th September, or just after the maximum number of weevils was caught in heavily infested fields, and when 75 per cent. of the squares were punctured. In 1931, in order to determine the time taken by weevils to spread various distances from hibernation quarters, traps were placed at intervals varying from $\frac{1}{8}$ to $1\frac{1}{4}$ miles from woodland bordering a strip

of level land mainly planted to cotton. It was found in both seasons that as infestation increased the accumulative catch on the traps did so also to approximately the same degree. In 1931, no weevils were caught in the traps, which were set up in March, until 23rd July. The first infestation was recorded on 18th June in cotton nearest to favourable hibernation quarters, when 3 per cent. of the squares were punctured. In 9 weeks the percentage had doubled, and the weevils had spread ¾ mile. About 3 weeks later they had again spread approximately as far again. Weevils were first taken on the traps at ¾, 1 and 1¼ miles on 4th, 7th and 11th September respectively. They thus appear to spread in cotton slowly for the first part of the season up to a point when they begin to migrate more rapidly and cover a larger territory. The maximum number of weevils was caught on a trap situated on a clear section between hibernation quarters and cotton during the first week in September, when movement in large numbers was taking place from field to field and distribution had become general. At this time weevils were caught at the greatest distances from hibernation quarters. This general migration occurred during a dry season, and may occur earlier in some years than others.

The maximum fruiting date in the later-planted cotton around the trap situated at the farthest point from hibernation quarters did not occur until the end of August. The abundance of fruit on this cotton was attractive to the weevils after the general migration period had begun, and the numbers caught there after 11th September were greater than on traps nearer the hibernation quarters.

BEINHART (E. G.). **A Control for the Tobacco Flea Beetle** (*Epitrix parvula*).—*J. Econ. Ent.*, xxv, no. 6, pp. 1187–1190, 1 ref. Geneva, N.Y., December 1932.

A spray of 50 U.S. gals. Bordeaux mixture (3 : 3 : 50 or 4 : 4 : 50) 2 lb. lead arsenate and 1 U.S. pt. 40 per cent. nicotine sulphate appears to give better control of *Epitrix parvula*, F., in tobacco seed beds than other materials that have been in use for some time. A single application with a standard horse-drawn potato sprayer effected complete control of a severe attack of flea-beetles (probably *E. cucumeris*, Harr.) on tobacco in northern California in 1929, and effective practical control of *E. parvula* in tobacco seed beds of North Carolina was obtained with it in 1932. For complete control the spray should be applied at intervals of 3–5 days from the time that the plants attain their cotyledons until they are 2–3 inches in diameter, at which size they are able to withstand a later infestation. It should be applied vertically downwards in order to secure complete coverage of the small buds and the surface of the whole plant.

BAILEY (S. F.). **A Method employed in rearing Thrips.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1194–1196, 1 fig., 2 refs. Geneva, N.Y., December 1932.

The following is substantially the author's abstract : A method used in rearing thrips is described in view of the increasing amount of work done on thrips of economic importance. A section of glass tubing is held upright by inserting it in a block of yucca wood. A cap of cellophane or bolting silk is placed over the upper end of the

tube. A strip of cotton is twisted tightly round the petiole of the leaf used for food before being inserted in the tube, thus securely plugging the lower end. The yucca block is then set on a small petri dish containing water, and the petiole, protruding from the tube below the lower edge of the block, has access to the water. Several tubes may be inserted in one block. This type of cage is advantageous in that the leaves can be kept fresh and easily changed, the thrips are readily observed, little space is required and the whole unit is very inexpensive.

KNULL (J. N.). **Observations on three important Forest Insects.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1196–1203, 2 pls., 5 refs. Geneva, N.Y., December 1932.

Aphrophora parallela, Say (pine spittle bug) has caused severe damage to plantings of Scots pine (*Pinus sylvestris*) in Pennsylvania, where it seems to be much more plentiful in some years than in others. Observations show that the pines make rapid growth on suitable soils for the first 15 years, after which some of them suddenly die. At first the smallest branches wither and turn brown, and afterwards the limbs die gradually from the bottom of the trunk upwards. An examination of cross sections of dead and dying trees shows rapid growth up to a point, then sudden retardation and gradual decrease in ring growth. Other conifers on which this Cercopid was found working were *P. strobus*, *P. rigida*, *P. resinosa*, *P. banksiana*, *P. virginiana* and *Picea excelsa* (*abies*). No perceptible injury was observed on these trees, however, and *P. sylvestris* seems to be the favourite food-plant, the globules of froth produced by the nymphs being larger on it and both nymphs and adults being more numerous. The eggs hatched about 4th May, and the young nymphs first appeared near the terminal buds. They tend to migrate from the tips of the branches, feeding as they travel down the limbs, until they finally congregate in large frothy clusters on the main trunks. Most of the adults appeared in the second half of June and had died by 1st September.

The constitution of the froth globules and the method of feeding of the adults are discussed. The injury produced causes a swelling of the twig and a scar on the surface of the smooth bark, small branches being often killed. Sections indicate that the wound reaches the secondary xylem tissue. Young pines are able to withstand infestation better than trees older than 15 years. Most of the injury to young trees is due to adult feeding, as the nymphs seem to confine their attacks chiefly to old growth. The bark-beetle, *Pityophthorus puberulus*, Lec., was found working in branches killed by *A. parallela*. Although the latter is free from most enemies, the adults were found to be attacked by the fungus, *Entomophthora aphrophora*, and mites, and single individuals by the nymph of a Reduviid, *Pselliopus cinctus*, F., and the Bembicid, *Gorytes* (*Hoplisus*) *atricornis*, Pack. Pyrethrum extract at the rate of 1 U.S. pint to 50 U.S. gals. water, with the addition of $1\frac{1}{2}$ lb. laundry soap, gave 100 per cent. control of nymphs in the final instar.

Tortrix (*Cacoecia*) *argyrospila*, Wlk., has caused considerable loss of oaks in various sections of Pennsylvania, *Quercus coccinea* being the most susceptible to injury, though several other species were

also defoliated and killed. Lists are given of these and of other trees and shrubs in the vicinity that were not attacked. The larvae spin the leaves together and feed and pupate within the shelter thus formed. There is only one generation a year, the moths emerging about the end of June. Many trees were often defoliated twice in the same season. Secondary attacks by *Agrilus bilineátus*, Web., often contributed largely to the death of trees that would otherwise have survived. Many of the larvae were killed by the fungus, *Entomophthora sphaerosperma*. Parasites reared from the pupae were *Sarcophaga houghi*, Aldr., and *Glypta simplicipes*, Cress., and from the larvae *Pimpla* (*Epiurus*) *indagator*, Cress., *Microgaster epagoges*, Gahan, *Apanteles* sp. and *A. cacoeciae*, Riley.

Ennomos subsignarius, Hb. (elm spanworm) appeared in large numbers at various points in the Allegheny Plateau section of Pennsylvania, where it was associated with *T. argyrospila* in the heaviest infestation found in 1931, but in addition to oaks it also attacked a number of other trees and shrubs, a list of which is given. The first moths emerged on 26th June, and by 4th July egg clusters were numerous on the under sides of the branches and sheltered places on the trunks, many of the eggs being parasitised by an undescribed species of *Telenomus*. The adults were inactive by day, but started to fly in swarms toward evening. Parasites reared from the pupae were *Zenillia blanda*, O.S., *S. houghi*, *S. latisterna*, Parker, *Pimpla* (*Itoplectis*) *conquisitor*, Say, *Theronia fulvescens*, Cress., and *Brachymeria compsilurae*, Crwf. Only one individual of the Carabid, *Calosoma scrutator*, F., was seen in 1931 in the vicinity of heaviest infestation, but large numbers of *C. calidum*, F., were observed in a locality where a similar infestation occurred in 1930.

MILLER (F. W.). **Mechanical Factors affecting the Feeding Habits of two Species of Aphids,** *Macrosiphum ambrosiae* **and** *Macrosiphum granarium*.—*J. Econ. Ent.*, xxv, no. 6, pp. 1203–1206, 7 refs. Geneva, N.Y., December 1932.

In order to determine some of the factors governing the seasonal oligophagy of Aphids, concerning which the observations of various workers are quoted, experiments, the technique of which is described, have been carried out with *Macrosiphum ambrosiae*, Thos., feeding on *Xanthium canadense*, and *M. granarium*, Kby., feeding on young shoots of wheat. The particular aim of these experiments was to find some factor or factors that might limit the Aphid to a particular part of the food-plant, and it was attempted to determine whether cutting off part of the setae would prevent subsequent feeding through the same thickness of cuticle, or whether the Aphid would migrate to places of thinner cuticle and there feed normally. It was found that when the setae of the stem feeder, *M. ambrosiae*, were shortened, it migrated to the leaves, which have a thinner cuticle, to feed. In the case of both *M. ambrosiae*, and the leaf feeder, *M. granarium*, if the setae were cut when extended to maximum length, feeding did not take place on any part of the food-plant. When the setae of *M. granarium* were cut before they had reached their full extension, the percentage of Aphids able to feed again varied with the amount of shortening.

Carter (R. H.). **The Chemical Composition of Commercially Available Fluorine Compounds.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1224–1227. Geneva, N.Y., December 1932.

This survey deals with 57 samples of 15 different fluorine compounds received from 16 sources. The composition of the compounds as determined by chemical analysis is shown, and their range of purity, which is generally of a very high order, is given in a table.

The following is taken from the author's abstract: The principal fluorine compounds that are now used as insecticides are sodium fluoride, sodium fluosilicate, barium fluosilicate, sodium fluoaluminate, potassium fluoaluminate and "calcium fluosilicate compound." A few years ago some of these compounds were unavailable. Others were variable in composition, and their high density and other physical properties made them ill-suited for spraying and especially for dusting. At the present time, however, pure fluorine compounds are available, and their physical properties have been improved by admixture of silica and in other ways so that they are quite satisfactory for spraying and dusting purposes.

Turner (N.). **Notes on Rotenone as an Insecticide.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1228–1237, 2 pls., 6 refs. Geneva, N.Y., December 1932.

A report is given on studies carried out during the period 1928–31 with commercially pure (98 per cent.) rotenone and with total extract of cubé root [*Lonchocarpus nicou*] containing large quantities of rotenone approximately one-half as toxic as pure rotenone. Tests on the effects of some materials on the stability of rotenone showed that it deteriorates quickly in the presence of soap and water, whether contained in the soap or incorporated in the oil which is emulsified with soap. It is apparently stable when dissolved directly in oil-soluble sulphonate (sulphonated mineral oil). Rotenone in oil is apparently stable when emulsified with powdered skimmed milk. Tests were also carried out to determine the value of rotenone as a contact insecticide and as an internal poison. Rotenone dissolved in oil-soluble sulphonate and applied at the rate of 1 : 40,000 gave excellent control of *Aphis pseudobrassicae*, Davis, on radishes in the greenhouse. Other experiments in which total cubé extract or rotenone, incorporated in oil by the use of some suitable solvent, were used, and in some cases compared with 40 per cent. nicotine sulphate, showed rotenone in small amounts to be highly toxic to a number of insects, a list of which is given. The only indication of toxicity to eggs, however, was obtained in the case of *Pteronus* (*Pteronidea*) *ribesii*, Scop.

Rotenone was shown to be highly effective as a stomach poison, and when used at the rate of 1 : 1,000, killed 80 per cent. of the larvae of *Leptinotarsa decemlineata*, Say (Colorado potato beetle) within two days. Lead arsenate at the rate of 1⅓ lb. in 100 U.S. gals. killed this percentage in one day. Rotenone in as small amounts as 1 : 12,500 parts of spray killed 75 per cent. of the larvae of *L. decemlineata*, but acted very slowly. Judging from the amount of foliage consumed, however, this dilution gave adequate protection to the plants. In one test involving small numbers, rotenone at the rate of 1 : 2,500

gave promising results in controlling larvae of *Phorbia* (*Hylemyia*) *brassicae*, Bch., on cabbages when poured round the bases of the plants.

Essig (E. O.). **The Cribrate Weevil,** *Brachyrhinus cribricollis* **(Gyllenhal).**—*J. Econ. Ent.*, xxv, no. 6, p. 1240. Geneva, N.Y., December 1932.

Adults of *Otiorrhynchus* (*Brachyrrhinus*) *cribricollis*, Gyll., were observed feeding on a number of ornamental plants in a locality in California, in which they were first noted in large numbers on 27th May 1932, after which date they soon disappeared. A reappearance of the weevils on 21st September, after which they again became abundant and destructive, indicates the occurrence of a second brood. *O. cribricollis* has been found in several counties in California since its first discovery there in 1928 [*R.A.E.*, A, xviii, 171]. As the larvae live in the soil and the adults hide themselves by day, its unobserved spread by means of potted and balled nursery stock has doubtless been considerable, particularly in view of the large variety of ornamental plants subject to attack.

Flanders (S. E.). **Observations on certain Insects in Australia in 1931.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1240–1241. Geneva, N.Y., December 1932.

Pseudococcus adonidum, L. (*longispinus*, Targ.) infesting quince trees near Sydney was observed to be heavily parasitised by the Encyrtid, *Anarhopus sydneyensis*, Timb. From the middle of April till the end of July 1931, large numbers of parasitised mealybugs were taken in burlap bands placed around the infested trees, but among vines a few miles distant, on which *P. adonidum* was numerous, *A. sydneyensis* did not appear to be present.

Coccus longulus, Dougl., infesting *Ceratonia siliqua* in Sydney was found in March 1931 to be highly parasitised by the Eulophid, *Aneristus ceroplastae*, How., hitherto considered a purely tropical species.

Saissetia oleae, Bern., although not a serious pest of *Citrus* in central Queensland, is very abundant there on certain native plants, particularly *Capparis*. The only parasite reared from it was *Scutellista* sp., which occurred in very small numbers. The Noctuid, *Catoblemma dubia*, Butl., was the most abundant predator.

One adult of *Etiella zinckenella*, Tr. (lima bean pod borer) was collected at light in Queensland.

Turner (N.). **Mexican Bean Beetle injuring Rye.**—*J. Econ. Ent.*, xxv, no. 6, p. 1241. Geneva, N.Y., December 1932.

Epilachna corrupta, Muls., was observed on 25th October causing serious injury to rye in Connecticut. The adult beetles had recently emerged and had migrated across a narrow road from an adjacent bean field in which all the beans had been killed by frost on 14th October.

JONES (W. M.). **A new Galleta Grass Gall.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1241–1242. Geneva, N.Y., December 1932.

Brief notes are given on an undescribed species of *Harmolita*, differing strikingly from those commonly found in grain and grass, which has been reared from galls on galleta grass (*Hilaria mutica*).

COLMAN (W.). **Effect of Yeast on Clothes Moth Larvae.**—*J. Econ. Ent.*, xxv, no. 6, p. 1242. Geneva, N.Y., December 1932.

The results of preliminary tests here described indicate that the growth of larvae of *Tineola bisselliella*, Humm., is greatly accelerated by supplementing their diet with dehydrated and pulverised brewers' yeast.

CARTER (R. H.). **The Incompatibility of Barium Fluosilicate and Nicotine Sulphate.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1242–1243. Geneva, N.Y., December 1932.

The scorching of tobacco foliage reported as resulting from the application of a combined spray of nicotine sulphate and barium fluosilicate [*R.A.E.*, A, xx, 296] is explained by the reactions of these two substances to form barium sulphate and nicotine fluosilicate. Barium sulphate, being a very insoluble compound, is largely precipitated, and the reverse reaction is therefore eliminated. The further reactions of the nicotine fluosilicate consequently formed have not been definitely determined, but even if it remains as such it would probably be injurious to plant foliage, since other fluosilicates have been found to cause severe scorching. It is further pointed out that barium fluosilicate is also chemically incompatible with lime-sulphur solution, hydrated lime and other calcium products (which precipitate the fluorine as insoluble calcium fluoride) and also with any soluble sulphate. Some well and spring waters contain sufficient soluble sulphates to render their use with barium fluosilicate inadvisable.

CARTER (R. H.). **Fluorine Residue on Apples.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1243–1244. Geneva, N.Y., December 1932.

Further notes [*cf. R.A.E.*, A, xx, 299] are given concerning the problem of the residue left on apples after spraying with fluorine compounds as compared with arsenical residues. Analyses of arsenical residues made in the apple growing sections of the north-western United States, which have a semi-arid climate and little or no rainfall during the growing season, and where as many as six cover sprays and one calyx spray are applied at concentrations ranging from 3 to 4 lb. insecticide to 100 U.S. gals. water, showed as much as 0·08 or 0·09 grains As_2O_3 per lb. of fruit, or 11–13 parts per million. The As_2O_3 residue figure represents approximately only 30 per cent. of the total residue calculated as lead arsenate. Washing processes, removing 90 per cent. or more of the residue, which must be resorted to to clean this fruit to meet an export tolerance of 0·01 grain As_2O_3 per lb., or 1·4 parts per million, have now been worked out quite satisfactorily.

Fluorine compounds applied at the same concentration and in the same manner as lead arsenate do not leave as much residue on sprayed apples, but fish-oil, oil emulsions and various adhesives are commonly used in combination with them, and these mixtures usually leave

heavier deposits on the fruit. Analyses of barium fluosilicate made over a period of two years on apples having received 4–5 cover sprays under commercial conditions showed an average residue of 0·15 grain barium fluosilicate per lb. equivalent to 0·061 grain fluorine (F.) per lb. or 8·7 parts per million. Preliminary washing experiments under commercial conditions indicated the easy removal of at least 75 per cent. of this residue, leaving approximately 0·015 grain fluorine (F.) per lb. or 2·1 parts per million. Apples so far examined for fluorine residue have been sprayed with barium fluosilicate which contains 40·75 per cent. pure fluorine. Fluorine insecticides that contain a greater proportion of pure fluorine, such as cryolite, which contains 1·3 times as much, may be expected to leave a higher fluorine residue on fruit if applied under identical conditions. It is, however, probable that the physical condition of these materials can be improved, and that better methods of application will be developed so that smaller concentrations will give better coverage, thereby decreasing the total residue without reducing the insecticidal effect.

Roark (R. C.). **Derris now produced and used on a large Scale.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1244–1245. Geneva, N.Y., December 1932.

Data collected from the literature are presented to show the extent to which derris is now produced in Malaya, the Netherlands Indies and Sarawak, the acreage under cultivation, number of trees planted to the acre and estimated yield. It is calculated that 10,000 acres are now under cultivation with a potential production of 5,000,000 lb. annually. From data collected from other workers it is estimated that 5,000,000 lb. of derris root would be equivalent to 93,750,000 lb. tobacco for the control of *Aphis rumicis*, L., and of 13,750,000 lb. pyrethrum flowers in the control of the greenhouse spider mite [*Tetranychus telarius*, L.].

In addition to being produced on a large and rapidly expanding scale, derris is available at a low cost, the wholesale price in New York being about 1s. per lb. for the air-dried unground root. The importance of obtaining derris root of guaranteed rotenone content is insisted upon, and it is pointed out that rotenone itself is now commercially available in the United States. Proprietary preparations containing derris or cubé extract are also on the market, and cubé root (*Lonchocarpus nicou*), samples of which have contained as much as 11 per cent. rotenone, has recently become commercially available.

Eyer (J. R.) & Tojada (E.). **Further Suggestions for improving Codling Moth Bait Trap Catches.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1246–1247. Geneva, N.Y., December 1932.

In the course of 4 years' experiments carried out in New Mexico to improve the attractiveness of bait traps for the codling moth [*Cydia pomonella*, L.], detailed studies of baits of the fermenting sugar and aromatic ester types have led to the recognition of 4 limiting factors, to overcome which the following devices have been found useful: the addition of 2 per cent. sodium benzoate to fermenting sugar baits to retard fermentation during hot weather; the addition of glycerine to aromatic esters when high temperatures cause over rapid volatilisation; the use of cone-shaped bait pails that cannot be upset by high winds or heavy rains and in which the baits present a maximum evaporating surface combined with a minimum volume

of bait ; and placing bait pails on the west side of the tree so that they will receive optimum light conditions at sunset.

Further studies have been conducted during 1932 with the object of determining the effect of surrounding baits with an electrified grid that will kill moths that do not actually fall into the pans and the part played by proper illumination by artificial light in increasing the attractiveness of baits. The results indicated that decided increases in catch may be obtained with either fermenting sugar or aromatic ester baits if provided with proper illumination and electrified grids.

Wilson (J. W.). **Notes on the Biology of *Laphygma exigua* Huebner.**—*Florida Ent.*, xvi, no. 3, pp. 33–39, 7 refs. Gainesville, Fla., November 1932.

In Florida, *Laphygma exigua*, Hb., causes much injury to *Asparagus plumosus* var. *nanus* and has also been observed on single occasions feeding on *Gladiolus* sp. and grass growing between infested plants. Its history in the United States, where it was first noticed in 1876, is outlined. The greatest injury to asparagus fern occurs during the rainy season, which is generally from mid-June or July to September, when the frequent and heavy rains wash insecticides from the plants. The younger larvae feed on one side of the tender buds at the tips of the shoots, causing them to curl over and eventually wither. Such tipless sprays have no market value. The older larvae attack any part of the plant, preferring the succulent sprays that have just finished expanding. The eggs are laid in masses on the lower side of the sprays, 45 females depositing an average of 516 each. The pre-oviposition period lasted 2–3 days and the oviposition period 4–5 days. Experiments showed that it was possible for newly emerged moths to withstand a temperature of 35–40°F. for at least 5 days and for oviposition to occur when the temperature again reached the optimum. Eggs kept at the same temperature for four days hatched two days later. From 14th June to 10th October six generations were reared, the life-cycle averaging 24 days. All stages of the insect occurred in the ferneries during the winter of 1931–32, indicating that the winter is passed in continued though retarded development. Parasites collected in ferneries where the caterpillars were numerous were, in the order of their importance : *Chelonus texanus*, Cress., *Meteorus autographae*, Mues., *Apanteles marginiventris*, Cress., *Euplectrus platyhypenae*, How., and single individuals of *Hyposoter interjectus*, Gahan, *Zele melleus*, Cress., *Gonia crassicornis*, F., and *Eucelatoria rubentis*, Coq. *Spilochalcis hirtifemora*, Ashm., *S. albifrons*, Walsh, *Catolaccus aeneoviridis*, Gir., and *Mesochorus* sp. were bred from cocoons of *A. marginiventris*. Predators attacking the larvae of *L. exigua* were *Polistes rubiginosus*, Lep., and *Podisus maculiventris*, Say, and the fungus, *Spicaria prasina* destroyed many larvae during the rainy period. Poultry also assist in keeping down their numbers.

Harned (R. W.). **Annual Report of the Department of Zoology and Entomology.**—*44th Ann. Rep. Mississippi Agric. Expt. Sta. 1930–31*, pp. 30–35. A. & M. College, Miss. [1932.]

A brief account is given of the investigations carried out by L. E. Myers on greenhouse mealybugs in Mississippi [*R.A.E.*, A, xx, 640].

J. M. Langston reports that eggs and young larvae of the pecan weevil [*Curculio caryae*, Horn] were found in nuts of pecan for the first time, larvae migrating to the soil 18 days after hatching. Covering the husks of the nuts in the spring reduced the emergence of shuckworms [*Enarmonia caryana*, Fitch] from 21 to 1·3 per cent. [*cf.* xviii, 548]. Weekly collections revealed 15·9 per cent. of the pecan nuts fallen from a seedling tree near hickory to be infested by *E. caryana*, whereas only 1·08 per cent. of those falling from trees 150 yards from hickory were attacked.

WORTHLEY (H. N.). **Emergence Cages and Bait Pails for timing Codling Moth Sprays.**—*Bull. Pennsylvania Agric. Expt. Sta.*, no. 277, 19 pp., 7 figs., 7 refs. State College, Pa., April 1932. [Recd. December 1932.]

In Pennsylvania, where it is a major pest of apples, the codling moth [*Cydia pomonella*, L.] has one complete generation and a partial second one, with possibly a partial third in the warmest parts of the State. The author describes the bionomics and seasonal history of the insect and discusses it in relation to spraying practices, comparing the use of emergence cage and bait pail records [*cf.* *R.A.E.*, A, xx, 583, 637, etc.] for determining the correct timing of spray applications. He considers that the cover sprays cannot be timed by means of calendar dates or comparisons with tree development, and no set programme could meet the requirements of all seasons and all localities in Pennsylvania. The behaviour of the insect in a particular orchard is best revealed by means of bait pail catches. Emergence cages, which require more care and attention in operation, are useful in orchards where the moth population is low, or where it may be desirable to mark the limits of the two generations, or to determine the percentage of larvae of the first generation that pupate. The first cover spray should be finished within 10 days after the first period of maximum moth activity as shown in the records, unless a recent spray for curculio [*Conotrachelus nenuphar*, Hbst.] has been applied. Subsequent sprays should be applied in the same manner after each maximum period, except where these indicate intervals of less than 10 days between spray applications. Spraying against the first generation only is considered, as if this is adequately done, there should be no need for spraying against any other generation. At critical times during the emergence period, heavy rains following a spray may indicate a shorter interval than 10 days, and slight moth activity occasioned by periods of low temperature may permit the interval to be lengthened. It is pointed out that spray dates based on such records may need to be modified by a consideration of other factors.

MIDDLETON (W.). **Two new Species of Sawflies of the Subgenus *Neodiprion*.**—*Proc. Ent. Soc. Wash.*, xxxiii, no. 7, pp. 171–176. Washington, D.C., October 1931.

Descriptions are given of both sexes of *Diprion* (*Neodiprion*) *swainei*, sp. n., from Jack pine (*Pinus banksiana*) in Quebec, and *D.* (*N.*) *burkei*, sp. n., from lodgepole pine (*P. contorta*) in Montana.

Burke (H. E.). **Two destructive Defoliators of Lodgepole Pine in the Yellowstone National Park.**—*Circ. U.S. Dept. Agric.*, no. 224, 19 pp., 9 figs., 10 refs. Washington, D.C., July 1932. [Recd. December 1932.]

In north-western Wyoming and south-western Montana during 1921–25, about 12,000 acres of lodgepole pine (*Pinus contorta*) were killed and considerable areas severely defoliated by *Diprion* (*Neodiprion*) *burkei*, Middleton (lodgepole sawfly) [see preceding paper] and a Tortricid, which though it has been identified as *Eulia* (*Argyrotaenia*) *pinatubana*, Kft. (pine tube moth) is thought by the author to be possibly another species owing to important differences in bionomics. All stages of both these insects are described. The most serious damage was caused between 6,500 and 6,800 feet above sea level and occurred in isolated areas varying from ½ to 3 sq. miles. Observations indicate that the trees are not killed unless these pests work in association. During 1924 and 1925, after the sawfly outbreak had subsided, defoliation by the moth continued, but most of the trees survived. *P. contorta* appears to be the principal food-plant of both species, though larvae of the moth and a few eggs of the sawfly were also found on whitebark pine (*P. albicaulis*).

The Tortricid hibernates as a pupa in a closely woven cocoon attached to fallen needles and other forest litter. Emergence normally occurs from 15th May to 15th July, but is greatly influenced by temperature. The moths are capable of flying several miles under favourable conditions. Eggs are laid in groups of 2–30 on the concave surface of needles on any part of the tree. The majority are deposited between 15th June and 10th July and hatch between 20th June and 10th July. The young larvae mine in the needles, usually those of the current year's growth, for 2–3 weeks, after which they form tubes by webbing together sometimes as many as 12–14 needles. Feeding takes place within the tube, which is lined with a white web. Tubes may be abandoned and new ones formed. In 6–8 weeks the larvae drop to the ground and pupate 3–5 days later ; practically all have pupated by 1st October.

D. burkei hibernates for one or several winters as a resting larva in a cocoon among fallen needles. Temperature appears to have little influence on the time of pupation, which occurs between the middle of May and the end of June and is soon followed by emergence. Adults are found from 1st June to the middle of July ; the females are not strong fliers, though the males are quite active. Eggs are laid soon after emergence in oval incisions cut in needles, usually those of the previous year, and hatch between mid-July and mid-August. Unfertilised eggs apparently do not hatch. The larvae are gregarious at first, but after midsummer they are more distributed, and the needles are eaten down to the sheaths, the older growth being chiefly attacked, though that of the current year may be injured. The larvae are nearly full-grown by 1st September.

Neither species appears to be influenced by severe climatic conditions. *Campoplex* sp. and *Phaeogenes* sp. were reared in fair numbers from the larvae of *E. pinatubana*, only one individual apparently developing in a single host. A Chalcid, 30 individuals of which emerged from one host, and an Ichneumonid and a Tachinid, which are solitary parasites, were bred from the cocoons of *D. burkei*. Ants were seen capturing male sawflies and in a few cases larvae in the cocoons were found dead and covered with a chalky-white fungus.

A spray of lead arsenate and fish-oil or linseed oil, as recommended against the gipsy moth [*Porthetria dispar*, L.] [*R.A.E.*, A, xv, 289], which was applied after the sawfly had disappeared, gave about 90 per cent. control of the caterpillars.

Hood (C. E.). **Injury to Peach Fruits by Gipsy-moth Larvae.**—*Circ. U.S. Dept. Agric.*, no. 235, 11 pp., 5 figs. Washington, D.C., July 1932. [Recd. December 1932.]

Complaints of injury in peach orchards by *Porthetria dispar*, L. (gipsy moth) in Massachusetts led to observations and experiments, conducted over four years, which showed that though the larvae feed readily on both fruit and foliage of apple and pear, on peaches they feed only sparingly on the older foliage, but attack the tender stems and small fruits and cause them to drop, and later eat out deep holes in the flesh of the larger fruits, making them unfit for market. Most of the damage is done by the small larvae ; in one locality about 50 per cent. of the fruit had been injured when the first spray was applied on 15th June. Good control was obtained by spraying, but this must be done early in the season as injury to the stem of the young fruit causes it to fall off later. Infestation generally arises from neighbouring woodlands, from which the larvae are blown considerable distances by wind, and this dispersion period is at its height about the time that the peach blossoms have fallen and while the fruit is very small. This is the time for spraying, the formula recommended being 2–3 lb. lead arsenate and 2–3 lb. hydrated lime in 100 U.S. gals. water. The addition of fish-oil to this mixture caused it to adhere much longer to the foliage, $\frac{1}{4}$ U.S. pint being required for each lb. arsenate or lime in the spray. If it seems necessary to prevent injury to the foliage by the lead arsenate, more hydrated lime can be added, with additional fish-oil in proportion. Sulphur or casein could also be added at this time. Care should be taken to cover the stem of the fruit with the poison, as the young larvae begin feeding at this point.

Wille (J.). **Der Kampf gegen die Fruchtfliegen in Nord- und Südamerika.** [Measures against Fruit-flies in North and South America.]—*NachrBl. deuts. PflSchDienst*, xii, no. 12, pp. 99–101. Berlin, December 1932.

This paper includes notes on the results of a fruit-fly survey carried out in Peru by Kisliuk and Cooley in co-operation with the author in March and April 1932. *Anastrepha fraterculus*, Wied., appeared to be the chief pest of fruits, *A. serpentina*, Wied., infesting only *Lucuma* and cherimoya [*Anona*]. Neither *A. peruviana*, Towns. [*R.A.E.*, A, i, 516] nor *Ceratitis capitata*, Wied., was found.

Hart (P. C.). **Topboorderaantasting en poepoeshardheid.** [Tip-borer Attack and Hardness of Shoots.]—*Arch. Suikerind. Ned.-Ind.*, 1932, no. 43, pp. 915–932 ; also as *Korte Meded. Proefst. Java Suikerind.*, no. 12. Surabaya, 1932.

As it appears very probable that hardness of the shoots, consequent on their content of dry tissue, is the main factor influencing injury to sugar-cane by the white tip-borer, *Scirpophaga intacta*, Sn., in Java

[*R.A.E.*, A, xix, 568], the results are recorded of a series of experiments made in 1932 to ascertain the amounts of dry tissue in the shoots of different varieties of cane growing under various conditions.

Blunck (H.). **Tausendfussfrass an Kartoffelknollen.** [Millepede Injury to Potato Tubers.]—*Z. PflKrankh.*, xliii, no. 1, pp. 13–20, 5 figs., 12 refs. Stuttgart, 1933 [1932].

In the summer of 1932 potato tubers in many localities in Schleswig-Holstein were severely injured by millepedes, the principal species concerned being, in order of importance, *Cylindroiulus teutonicus*, Poc., *C. frisius*, Verhoeff, *Oncoiulus foetidus*, Koch, and *Blaniulus* sp. (? *guttulatus*, Bosc). In early potatoes the injury was often so severe as to destroy all their market value. Millepedes are generally considered to be secondary pests, but in this outbreak sound potatoes also appeared to be attacked. It is suggested that the dry heat in June and July produced cracks in the tubers and led the millepedes to attack them in search of water, as wireworms do [*R.A.E.*, A, xx, 492].

von Tubeuf (C.). **Ein ungewöhnlicher Fall von ausgedehnter Cecidomyiose in einem Kiefernstangenholze.** [An unusual Case of extensive Cecidomyiid Infestation in a Pine Pole Wood.]—*Z. PflKrankh.*, xliii, no. 1, pp. 29–30, 1 fig. Stuttgart, 1933 [1932].

As a rule *Thecodiplosis* (*Cecidomyia*) *brachyntera*, Schwaegr., attacks young plantations of pines, but at Heideck, Germany, it was found infesting pines in a pole wood, the injury causing the needles at the tips of the branches to turn yellow.

Rambousek (F.) & Neuwirth (F.). **Klimatische Bedingungen für das Erscheinen der Rübenfliege** (*Pegomyia hyoscyami*). [Climatic Conditions for the Appearance of the Beet Fly. (*In Czech* with a Summary in French.)]—*Věst. čsl. akad. zeměd.*, viii, p. 193. Prague, 1932. (Abstract in *Z. PflKrankh.*, xliii, no. 1, p. 42. Stuttgart, 1933 [1932].)

Observations on the beet fly, *Pegomyia hyoscyami*, Panz., in Bohemia showed that outbreaks are checked by a hot summer, unusually warm autumn, rather mild winter, and a spring that is prematurely warm and then turns cold. Conditions favourable to the fly are a cool summer, normal autumn, normally cold winter, and normal spring. If June and July are cool, the Braconid parasites, *Apanteles congestus*, Nees, and *Opius nitidulator*, Nees, do not appear until the larvae of the second generation have already entered the ground, whereas if these months are hot, the development of the parasites is accelerated so that the second generation is controlled.

Schoevers (T. A. C.). **Bestuiven en bestuivers.** [Dusting and Dusters.]—*Versl. PlZiektenk. Dienst*, no. 67, 24 pp., 8 pls. Wageningen, December 1932 ; also in *Tijdschr. PlZiekten*, xxxviii, no. 11, pp. 229–252, 8 pls. Wageningen, November 1932.

This is a general discussion of the use of dusts for the control of insects and fungi and the types of equipment employed for their application.

van Poeteren (N.). **De Coloradokever.** [The Colorado Beetle.]—*Versl. PlZiektenk. Dienst*, no. 68, 24 pp., 2 pls. Wageningen, December 1932; also in *Tijdschr. PlZiekten*, xxxviii, no. 12, pp. 253–276, 2 pls. Wageningen, December 1932.

In view of the danger of the introduction of *Leptinotarsa decemlineata*, Say, into Holland, an account is given of its bionomics and control. A map, with dates, shows its distribution in France and the various places in Europe in which it has been recorded in the past. Regulations of 7th July 1932 provide for the prohibition of the importation into Holland, between 15th March and 14th October, of potatoes or fresh vegetables from such countries as may be specified, unless they are certified free from infestation and have originated from localities at least 120 miles distant from an area in which the beetle occurs.

von Tubeuf (C.). **Warnung. Ein neuer Schädling wieder vor den Toren Deutschlands.** [A Warning. A new Pest again at the Gates of Germany.]—*Z. PflKrankh.*, xlii, no. 12, pp. 561–567, 7 figs. Stuttgart, 1932.

In view of the occurrence of the San José scale, *Aspidiotus perniciosus*, Comst., in Hungary and Austria [*R.A.E.*, A, xx, 506, etc.], an account is given of its bionomics and control. It has once been found in Germany, on pears imported from America.

Hering (M.). **Minenstudien 13.** [Studies of Leaf-mining Insects, 13.]—*Z. PflKrankh.*, xlii, no. 12, pp. 567–579, 5 figs., 6 refs. Stuttgart, 1932.

This paper includes a description of *Nepticula mali*, sp. n., from the leaves of apple near Paris.

Blattný (C.). **Poznámky k Výskytu Červce San José** (*Aspidiotus perniciosus* **Comst.) a k Boji proti němu v Evropě.** [Notes on the Occurrence of the San José Scale and its Control in Europe.]—*Ochr. Rost.*, xii, no. 3–4, pp. 69–78, 1 fig. Prague, 1932. (With a Summary in German.)

In view of the occurrence of *Aspidiotus perniciosus*, Comst. (San José scale) in Hungary and its introduction into Austria, an account is given of the regulations passed against it in Hungary [*R.A.E.*, A, xx, 506] and Czechoslovakia early in 1932. The existing prohibition of the import into Czechoslovakia from America, Australia, China, Japan, Hawaii, and New Zealand of all plants or parts of plants liable to carry infestation has been extended to include Africa, Austria and Hungary. Fresh fruit, however, may be imported if found free from infestation.

Magerstein (Č.). **Bejlomorka růžicotvorná** (*Rhabdophaga rosaria* **H. Loew) na Konopině** (*Salix viminalis*). [The Gall-midge (*R. rosaria*, H. Lw.) on Osier (*S. viminalis*).]—*Ochr. Rost.*, xii, no. 3–4, pp. 86–89, 2 figs. Prague, 1932. (With a Summary in German.)

In 1932, the Cecidomyiid, *Rhabdophaga rosaria*, H. Lw., caused extensive damage to *Salix viminalis* grown for the manufacture of

baskets in the province of Moravia, Czechoslovakia about 60 per cent. of the plants examined being found to be infested. The eggs are laid in the terminal buds of young shoots, one in each bud, which the larva destroys. Round the injured growing point a dense rosette of leaves is formed, from the centre of which 3–8 shoots develop, while side branches grow from buds situated below the rosette. The second generation attacked chiefly the buds at the tips of the shoots growing from the rosettes, causing further branching. No shoots developed from rosettes growing in shade. A list is given of several other species of wild and cultivated willow that were more or less severely attacked.

Mesnil (L.) & Pétré (F.). **Un Anthomyidae (Dipt.) nuisible aux céréales en France.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 15, pp. 217–222, 3 figs., 9 refs. Paris, 1932.

Phorbia (*Chortophila*) *sepia*, Mg., of which *P.* (*Adia*) *genitalis*, Schnabl, is stated by Villeneuve to be a synonym, is a widespread pest of wheat and rye in France, as well as in Russia, Hungary and Greece and also occurs in Germany and England. It is generally present in wheat fields in March and April. The egg is probably deposited on the top leaf, and the young larva works in a spiral down the interior of the plant, arresting the growth of the leaves and producing a rush of sap which gives a peculiar consistency to the central part of the young plant in the neighbourhood of the terminal shoot, where the insect begins to develop. The youngest leaf turns yellow while the others remain green ; this generally happens in the latter half of May and the beginning of June. Pupation occurs in the gallery in June, the adult emerging in the following spring. In the Mediterranean region, there seems to be a second generation in the autumn, which damages young cereals. The larva, pupa and adult are described.

[Printz (Ya. I.).] Prinz (J.). **Zur Epidemiologie der Schmierlaus (*Pseudococcus citri* R. in Transkaukasien).** [On the Epidemiology of the Mealybug, *P. citri*, in Transcaucasia.]—*Anz. Schädlingsk.*, viii, no. 12, pp. 145–148, 1 graph. Berlin, 15th December 1932.

Much of the information in this paper on *Pseudococcus citri*, Risso, on vines has already been noticed [*R.A.E.*, A, xxi, 10]. Since numbers of this mealybug are killed by frost, winter treatments are probably only economically justified if the weather is exceptionally mild. It is important to obtain data on the distribution of *P. citri* in the vine-growing districts of Transcaucasia with a view to issuing quarantine regulations against its spread.

Suter (P.). **Der Apfelblattsaugerherd in Egnach (Schweiz).** [The Apple Leaf-sucker Centre of Infestation at Egnach (Switzerland).] —*Anz. Schädlingsk.*, viii, no. 12, pp. 148–155, 9 figs. Berlin, 15th December 1932.

The severe injury done to apple by *Psylla mali*, Schm., in May 1930 at Egnach, on the Swiss shore of Lake Constance, led to investigations in 1931 on its bionomics and control. The first young nymphs

were observed on 20th April, and the nymphal stage lasted 37 days. Adults were present in June, July, and the first half of August. Late-blossoming varieties of apple suffered much less than others. In 1931 favourable weather ensured the rapid completion of blossoming and although nymphs were abundant, little harm was done, contrary to what occurred in 1930. Tar-distillates, especially high-boiling fractions, proved a cheap and reliable means of destroying the eggs. Against the nymphs on the buds a spray containing nicotine, lime-sulphur and lead arsenate is recommended, as it was also found effective in controlling Aphids, the winter-moth [*Cheimatobia brumata*, L.] and apple scab.

Papers noticed by Title only.

Green (E. E.). **Notes on some Coccidae from Iceland.**—*Ent. Tidskr.*, lii, no. 3–4, pp. 263–269, 1 pl., 4 figs. Stockholm, 1931. [Recd. January 1933.]

Robinson (D. H.) & Jary (S. G.). **Agricultural Entomology.**—Ex. Cr. 8vo, 326 pp. London, G. Duckworth & Co. Ltd., 1932. Price 6*s*. [Cheap edn. of work already noticed, *R.A.E.*, A, xvii, 186.]

Petch (T.). **A List of the entomogenous Fungi of Great Britain.**—*Trans. Brit. Mycol. Soc.*, xvii, pt. 3, pp. 170–178. Cambridge, November 1932.

Balachowsky (A.). **Contribution à l'étude des Coccides de France. (11e note). Supplément à la liste des Coccides des Alpes-Maritimes et du Var avec description d'un** *Eriococcus* **nouveau.**—*Bull. Soc. ent. Fr.*, xxxvii, no. 16, pp. 233–238, 6 figs., 4 refs. Paris, 1932.

Holzapfel (M.) & others. **Die Gewächshausfauna des Berner Botanischen Gartens.** [The Greenhouse Fauna of the Berne Botanical Garden.]—*Rev. suisse Zool.*, xxxix, no. 3, pp. 325–374, 9 figs., 59 refs. Geneva, August 1932.

Chitwood (B. G.). **A Synopsis of the Nematodes parasitic in Insects of the Family Blattidae.**—*Z. Parasitenk.*, v, no. 1, pp. 14–50, 59 figs., 16 refs. Berlin, 1932.

Blattný (C.). **Is it possible to detect the Presence of the Virus causing some Diseases of Potatoes in their Carriers, the Aphids?** [*In Czech.*]—*Mém. Soc. Sci. Bohême*, 1931, no. 4, pp. 1–7, 3 figs., 6 refs. Prague, 1932. (With a Summary in English.) [See *R.A.E.*, A, xix, 642.]

Smolák (J.). **Názvosloví škodlivých Činitelů ovocných Kultur. (Škůdcové živočišní.)** [The Nomenclature of Factors injurious to Fruit Crops. (Animal Pests.) (List of 127 species of mites and insects attacking fruit-trees, vine, etc., under their popular names in Czech with scientific equivalents, and in some cases indications of the injury caused.)]—*Och. Rost.*, xii, no. 3–4, pp. 89–93. Prague, 1932.

Laing (F.). **On a Small Collection of Coccidae from the Belgian Congo.**—*Rev. Zool. Bot. afr.*, xxiii, fasc. 1, pp. 61–69, 9 figs. Brussels, 30th December 1932.

VERBEEK (F. A. T. H.). **De ontwikkelings-stadia van *Mylabris* en *Epicauta* in de tropen.** [The developmental Stages of *Mylabris* and *Epicauta* in the Tropics.]—*Tijdschr. Ent.*, lxxv, Suppl., pp. 163–169, 11 figs. Amsterdam, 1932.

KALSHOVEN (L. G. E.). **A Note on some early Contributions on Dutch East Indian Scolytids (up to 1910).**—*Tijdschr. Ent.*, lxxv, Suppl., pp. 242–253. Amsterdam, 1932.

MUSGRAVE (A.). **Bibliography of Australian Entomology 1775–1930 with biographical Notes on Authors and Collectors** [including a subject index].—Roy. 8vo, viii+380 pp. Sydney, R. Zool. Soc. N.S.W., September 1932.

WOMERSLEY (H.). **The Collembola-Symphypleona of Australia : A preliminary Account.**—*Pamph. Counc. Sci. Ind. Res. Aust.*, no. 34, 47 pp., 19 figs., 111 refs. Melbourne, 1932.

UCHIDA (T.). **Beiträge zur Kenntnis der japanischen Ichneumoniden** [including *Ephialtes laspeyresiae*, sp. n., from *Cydia* (*Laspeyresia*) *molesta*, Busck].—*Insecta matsum.*, vi, no. 4, pp. 145–168, 1 pl., 17 figs. Sapporo, November 1932.

UCHIDA (T.). **H. Sauter's Formosa-Ausbeute. Ichneumonidae (Hym.)** [including a review of Formosan Ichneumonidae].—*J. Fac. Agric. Hokkaido Imp. Univ.*, xxxiii, pt. 2, pp. 133–222, 23 figs. Sapporo, November 1932.

OSBORN (H.). **Supplemental Records and Notes on Ohio Leafhoppers.**—*Ohio J. Sci.*, xxxii, no. 6, pp. 513–517. Columbus, Ohio, November 1932. [*Cf. R.A.E.*, A, xvi, 691.]

SNAPP (O. I.). **Oil Emulsions as Insecticides and their Use for the Control of Scale Insects on Fruit Trees.**—*Proc. Tenn. Hort. Soc.*, xxvii (1931), pp. 14–28. Harriman, Tenn. [1932.] [*Cf. R.A.E.*, A, xx, 18.]

ALLEN (H. W.) & HAEUSSLER (G. J.). **An Attempt to establish an American Parasite** [*Macrocentrus ancylivora*, Rohw.] **of the Oriental Fruit Moth** [*Cydia molesta*, Busck] **in France.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1148–1151. Geneva, N.Y., December 1932. [*Cf. R.A.E.*, A, xxi, 6.]

ESSIG (E. O.). **The original Description of *Dialeurodes citri* (Ashmead).**—*J. Econ. Ent.*, xxv, no. 6, pp. 1207–1208. Geneva, N.Y., December 1932.

HOSKINS (W. M.). **Toxicity and Permeability. I. The Toxicity of acid and basic Solutions of Sodium Arsenite to Mosquito Pupae.**—*J. Econ. Ent.*, xxv, no. 6, pp. 1212–1224, 3 graphs, 32 refs. Geneva, N.Y., December 1932. [*Cf. R.A.E.*, B, xxi, 34.]

BRADLEY (M. A.) & HUNT (M. G.). **Index to Publications of the United States Department of Agriculture 1901–1925.**—Med. 8vo, vi+2689 pp. Washington, D.C., Govt. Ptg. Office, 1932. Price, buckram, \$3·25.

Eggers (H.). **Neue Borkenkäfer (Ipidae, Col.) aus Africa (Nachtrag v).** [New Bark-beetles from Africa, Supplement v.]—*Rev. Zool. Bot. afr.*, xxii, no. 3, pp. 291–304. Brussels, 20th December 1932.

This paper, which is one of a series [*R.A.E.*, A, xx, 592, etc.], includes a description of *Poecilips sierraleonensis*, sp. n., from fruit-stalks of mango and pods of *Poinciana* in Sierra Leone. This Scolytid has also been found in South India in berries of Liberia coffee, possibly as a result of introduction from Africa.

Priesner (H.). **Thysanopteren aus dem Belgischen Congo.** [Thysanoptera from the Belgian Congo.]—*Rev. Zool. Bot. afr.*, xxii, nos. 2–3, pp. 192–221, 320–344, 20 figs. Brussels, 1932.

The second part of this paper includes a key to the African species of *Elaphrothrips* and a description of *E. decipiens*, sp. n., on cotton.

Hooper (C. H.). **The Insect Visitors of Fruit Blossoms.**—*J. R. Soc. Arts*, lxxxi, no. 4177, pp. 86–105, 2 pls. London, 9th December 1932.

The varying importance of different insects in the pollination of fruit blossoms is discussed, with brief notes on the species concerned in Britain [*R.A.E.*, A, x, 391 ; xii, 127 ; xvii, 496 ; xix, 375]. In the discussion on the paper, D. Morland suggested that though arsenicals applied against orchard pests in the form of a spray will kill adult bees before they reach the hive, arsenic in the form of a dust might be taken into the hive, and though it would not enter the honey in any injurious quantity, it might cause mortality among the brood.

Martin (H.). **The present Uses and future Development of Spray Spreaders.**—*Hort. Educ. Ass. Yearb.*, i, pp. 76–84, 24 refs. Wye, Kent, S.-E. Agric. Coll., 1932.

The following is the author's summary : It is suggested that the term spreader be confined to materials the principal function of which is to increase the ability of the spray to wet, in order that they may be differentiated from spreaders that serve mainly to enhance the retention of spray deposit. The mechanism of spreading action is discussed, and methods of comparing the efficiency of spreaders by measurement of the surface tension of their solutions are shown to be inadequate. A method is given for preparing soap solutions whereby the boiling-up process commonly used to prepare soft soap solutions is avoided. The limitations of soaps as spreaders are described, and progress made in the production of synthetic spreaders is discussed. It is suggested that concentrated sulphite lye, a by-product from wood pulp manufacture, may be a useful and cheap spreader. The possibility of using certain waste products of petroleum oil refining is discussed. Illustrations are given of the effect of the addition of spreaders on the toxic action of certain fungicides in order to show that recommendations regarding the use of spreaders should not be made without satisfactory field trials.

AUSTIN (M. D.), JARY (S. G.) & MARTIN (H.). **Some new Insecticides and possible Insecticide-Fungicide Combinations.**—*Hort. Educ. Ass. Yearb.*, i, pp. 85–92, 4 refs. Wye, Kent, S.-E. Agric. Coll., 1932.

The following is largely taken from the authors' summary: In laboratory tests against *Phorodon humuli*, Schr. (hop-damson aphis), anabasine, with sodium oleate or sulphite lye as the spreader, had an insecticidal action equal to or better than that of nicotine at the same weight concentration. Rotenone (1 : 75,000) in freshly-prepared diacetone alcohol solution, using sodium oleate or sulphite lye as the spreader, had an insecticidal efficiency of the same order as that of nicotine (1 : 16,000). Two proprietary nicotine preparations that do not need the addition of a spreader were found to be sufficiently effective to warrant field trial. Cottonseed oil, emulsified with either sodium oleate or Bordeaux mixture, was highly toxic. Dilute solutions of sulphite lye had little insecticidal action, whereas sodium oleate had a definite toxicity. Two modifications of Bordeaux mixture, namely, Bordeaux mixture (4 : 6 : 100) with 0·75 per cent. cottonseed oil, and Bordeaux mixture (8 : 12 : 100) with 0·75 per cent. concentrated sulphite lye (60°Tw.), designed for application to foliage in large quantities in order that a contact insecticide may be incorporated in the wash, were as effective as soap solutions as carriers for nicotine or pyrethrum extract. The soap solution prepared by the addition of oleic acid to dilute solutions of sodium hydroxide was a satisfactory substitute for soft soap solution.

Tests against *Hoplocampa testudinea*, Klug, on apple in the field were made with 8 oz. nicotine in 100 gals. Bordeaux (4–6–100) containing 6 pints cottonseed oil or Bordeaux (8–12–100) containing 6 pints sulphite lye, in comparison with nicotine-soap and two proprietary preparations containing rotenone. The sprays were applied on the day after the majority of the eggs hatched. In all cases they effected a marked reduction in the number of attacked fruitlets, but no conclusions can be drawn as to their relative merits in controlling *H. testudinea*. No injury to the trees was caused by heavy applications of the two Bordeaux combinations.

KOCH (R.). **Bestimmungstabellen der Insekten an Kiefer und Lärche nach den Frassbeschädigungen.** [Keys to the Insects of Pine and Larch according to the Injury caused by Feeding.]—2nd edn., Cr. 8vo, vi+218 pp., 247 figs. Berlin, Paul Parey, 1932. Price *M*.7.40.

In these keys to insects attacking pine and larch in Germany the insects concerned and the damage they do are described and also illustrated in many cases.

HARDY (G. H.). [Report of] **Walter & Eliza Hall Fellow in Economic Biology.**—27 pp. mimeograph. Brisbane, Queensland Univ., 1932.

In one section of this report (pp. 21–27) the author reviews the work that has been done in Australia on the subject of bunchy-top of bananas and the Aphid, *Pentalonia nigronervosa*, Coq., during the years 1926–1931.

QUEENSLAND. **Eighth Annual Report of the Prickly-pear Land Commission, being for the Year ended 30th June 1932.**—Fol., 27 pp., 1 map. Brisbane, 1932.

As a result of the work of the Commonwealth Prickly-pear Board, *Cactoblastis* [*cactorum*, Berg.] has become established throughout the areas infested by prickly-pear (*Opuntia*) in Queensland, and distribution during the year under review was confined to the liberation of 3,100,000 eggs on a few isolated areas where the insect was not previously established. Over areas totalling several million acres of a former dense infestation, little or no original prickly-pear remains. The problem of regrowth, which was discussed in the previous year's report [*R.A.E.*, A, xx, 157], has again to be dealt with. This growth made its appearance after the September-October oviposition period of *Cactoblastis*, and so flourished free from attack until the hatching of the eggs of the second generation in March. *Cactoblastis*, however, possesses great recuperative powers and rapidly multiplies on the soft, succulent regrowth, which is far more favourable to it than the hard, woody stems of primary pear. The distribution of this secondary growth is discussed, and it is thought that it may perhaps become necessary to re-distribute *Cactoblastis*. In a few districts associated with a particularly robust type of *Opuntia*, the caterpillars are unable to complete development on any but the succulent terminal segments, and it is probable that prickly-pear will persist for a prolonged period in these areas, being gradually reduced with each succeeding attack of *Cactoblastis*. The unusually dry summer period of January-March permitted a rapid increase of the cochineal insect [*Dactylopius*], which was more generally and thickly distributed than in recent years. In Central Queensland, heavy infestation of the velvety tree-pear (*O. tomentosa*) occurred in certain localities. The special strain of cochineal attacking the white-spined pear (*O. streptacantha*) has been very successful in destroying young plants and in thinning out the dense thickets. The Coreid, *Chelinidea tabulata*, Burm., has diminished greatly in numbers where *Cactoblastis* has destroyed most of the prickly-pear, but it is still abundant in certain areas.

DUMBLETON (L. J.). **The Apple Leaf-roller** (*Tortrix postvittana* **Walker**).—*N. Z. J. Sci. Tech.*, xiv, no. 2, pp. 83–92, 4 figs., 8 refs. Wellington, N.Z., October 1932.

Investigations on the biology of leaf-rollers attacking apples in Nelson, New Zealand, were commenced in October 1931. A total of 671 Tortricids belonging to 7 species were caught in baits in one orchard from the beginning of November 1931 until the end of March 1932, but 84·8 per cent. of these were *Tortrix postvittana*, Wlk., and rearing experiments indicated an even higher prevalence of the larvae of this moth on apple. The larvae of all the species taken are polyphagous and may occur in association, their proportions varying on different food-plants.

The adults of *T. postvittana*, all stages of which are described, shelter on the lower surface of the leaves during the day, flight and oviposition occurring between 6 and 10 p.m. The eggs are laid in masses on the leaves, stems or fruit, each female apparently being capable of producing over 300, though the average number deposited in the laboratory was about 100. Eggs laid by unfertilised females were not observed

to hatch. The young larvae disperse by crawling or dropping by silken threads, at which time they are easily carried by the wind. They feed under cover of a silken web, usually in a fold of a leaf or between two adjacent leaves. The older larvae cause the characteristic rolled leaves, in which they pupate in cocoons. In the summer there are at least two generations, which overlap considerably, the numbers reaching a maximum about the end of February. Experimentally three generations were reared during the course of a year. There is no suspension of activity during the winter, the larvae developing throughout this period on evergreens or garden plants.

T. postvittana may be controlled by the arsenical sprays applied against the codling moth [*Cydia pomonella*, L.], provided that a good coverage is maintained, especially during the late summer. Observations in the Nelson area and elsewhere indicate that a fairly high degree of control is effected by natural enemies. Of these the most effective appear to be a Braconid, *Apanteles* sp., which in the Nelson area parasitised at least 20–30 per cent. of the larvae, from each of which a single parasite emerges to pupate in a cocoon in the rolled leaf ; a Tachinid, *Phorocera* sp., which usually emerges from the mature larva or sometimes from the pupa ; and *Ichneumon* sp., which parasitised 15–30 per cent. of the pupae, the entire development taking place in this stage of the host. The eggs were attacked by *Trichogramma minutum*, Riley, and about 5 per cent. of the larvae by *Eulophus* sp., 1–2 per cent. by a Bethylid, *Goniozus* sp. (probably *G. antipodum*, Westw.), and 1–2 per cent. by a species of *Apanteles* that occurs in numbers in individual hosts. The pupae were also parasitised by *Eupteromalus* sp. and occasionally by the Ichneumonid, *Echthromorpha intricatoria*, F. A Gregarine and a Nematode were common in the mid-gut of the larvae.

DUMBLETON (L. J.). **Codling-moth Investigations.**—*N. Z. J. Sci. Tech.*, xiv, no. 2, pp. 114–117, 2 graphs. Wellington, N.Z., October 1932.

Data on the activity of adults of the codling moth [*Cydia pomonella*, L.] in the Nelson district, New Zealand, during the season 1931–32 were obtained by means of baits, the use of which as an indicator of the abundance of moths should result in a greater efficiency in the application of control measures. Tins, 6 ins. in diameter and 6 ins. deep, were hung on the outside of the trees (one to each of 40 trees) at a height of 8–12 ft. by a wire handle and hook, and half-filled with a mixture of 4 lb. brown sugar in 12 gals. water with sufficient yeast to start fermentation, the bait being renewed every 7 days. A recording thermograph was placed under a tree in a well-ventilated box about 4 ft. from the ground. The baits were effective, and no additional attraction resulted from the use of geraniol. Records taken daily from 10th November 1931 to 27th January 1932 revealed some correlation between temperature and abundance of the moths ; activity began at 55°F., and was greatest between 60 and 70°. Weekly observations showed that the largest numbers occurred between 17th and 24th November, the last moths being caught between 17th and 24th February.

In general it would appear that *C. pomonella* has only one generation a year in most parts of New Zealand. In normal years the moths are

emerging from the beginning of November to the end of January, and oviposition may continue up to the end of February. The first larvae leave the apples in the second half of January. In the Hastings area, however, where the spring is warmer and the rainfall less than in other orchard areas, two generations often occur.

SIMMONDS (H. W.). **Weeds in Relation to Agriculture.**—*Agric. J. Fiji*, v, no. 2, pp. 58–62. Suva, 1932.

The author discusses various aspects of the utilisation of insects to control noxious weeds [*cf. R.A.E.*, A, xvii, 545 ; xix, 468, etc.], and as an illustration of the danger of such insects becoming adapted to new food-plants cites the Lycaenid, *Tmolus* (*Thecla*) *echion*, L., which, since its introduction into Hawaii for the control of *Lantana*, has been found attacking egg-plant [*Solanum melongena*], and the weevil, *Elytroteinus subtruncatus*, Fairm., which attacks *Begonia* in Fiji, ginger in Hawaii and lemons in the Cook Islands [xviii, 10].

REYES (G. M.). **An unreported fungous Disease of the Philippine Migratory Locust.**—*Philipp. J. Sci.*, xlix, no. 3, pp. 407–418, 5 pls., 16 refs. Manila, 1932.

In 1929, *Beauveria globulifera* was observed infesting *Locusta migratoria migratorioides*, Rch. & Frm., in an insectary in the Philippines. The fungus was isolated in pure culture and proved highly pathogenic to the locust, death occurring in from 1 to 6 days after infection, the younger or newly moulted stages being the most susceptible. On artificial media the fungus was still viable after 295 days at room temperature or 320 days in the ice box. Steamed glutinous rice seemed the best medium on which to cultivate it.

REYES (G. M.). **Artificial Infection of the Coconut Leaf Miner with** *Beauveria globulifera* **(Spegazzini) Picard.**—*Philipp. J. Sci.*, xlix, no. 3, pp. 419–441, 5 pls., 19 refs. Manila, 1932.

An account is given of experiments to determine the practicability of utilising the fungus, *Beauveria globulifera*, isolated from *Locusta migratoria migratorioides*, Rch. & Frm. [see preceding paper] against the leaf-miner, *Promecotheca cumingi*, Baly, on coconut in the Philippines. The methods adopted for inducing the disease included dusting the beetles with spores, spraying them or the lower surface of the leaves with a suspension of spores in water, or applying spores on some individuals and releasing them with healthy ones. In the last experiment, infection by natural contact was not demonstrated. Under natural conditions, spraying the beetles with spores while they were feeding on the leaves proved the most effective, and caused a high percentage of mortality, as the insects were exposed to both external and internal infection. Under conditions approximating as far as possible to natural ones, 44–67 per cent. mortality was caused among the beetles, and in greenhouses up to 73 per cent. Experiments in the field were not extensive enough, and further tests should be made to determine more definitely the efficacy of this fungus before recommendations can be made. Spores sprayed on the leaves remained viable for over 2 months and would probably do so for a considerably

longer period. Although this fungus has been reported as infecting many kinds of plants, healthy coconut palms are apparently immune from it.

Butler (H. G.). **Parasites of the Oriental Fruit Moth in Roane County, Tennessee, Harriman, Tenn, 1931.**—*Proc. Tenn. Hort. Soc.*, xxvii (1931), pp. 75–80. Harriman, Tenn. [1932.]

Investigations in Tennessee showed that 78·74 per cent. of the larvae of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth) in peach twigs were parasitised in 1930 and 50·85 per cent. in 1931, the lower rate being probably due to climatic conditions. In 1931 parasitism was first observed on 16th June and increased steadily until August. Of 1,605 parasites reared, 1,550 were *Macrocentrus delicatus*, Cress., and the others included an undescribed species of *Cremastus*, *C. minor*, Cush., *Eubadizon* sp., *Glypta rufiscutellaris*, Cress., *Lixophaga mediocris*, Aldr., *Microbracon mellitor*, Say, *Macrocentrus ancylivora*, Rohw., and *Pristomerus ocellatus*, Cush., the last two being species introduced from New Jersey. In 1930 two colonies of *M. ancylivora* were liberated, and recoveries were made from one in that year and from both in the following year, which, though they were unexpectedly small, indicate that the parasite is capable of overwintering in Tennessee. Individuals have been recovered from 2 of 4 further colonies introduced in 1931 and from 1 of 3 colonies of *P. ocellatus* [*R.A.E.*, A, xx, 215].

Marcovitch (S.) & Stanley (W. W.). **A preliminary Report on arsenical Substitutes for Peach Spraying.**—*Proc. Tenn. Hort. Soc.*, xxvii (1931), pp. 86–92. Harriman, Tenn. [1932.]

An account is given of experiments carried out in Tennessee in 1930 and 1931 on the value of barium fluosilicate and cryolite as substitutes for lead arsenate in the control of *Cydia* (*Laspeyresia*) *molesta*, Busck (oriental fruit moth) and the curculio [*Conotrachelus nenuphar*, Hbst.] on peaches. The results obtained in the former year have already been noticed [*R.A.E.*, A, xix, 672]. The comparatively light infestation in 1931 rendered difficult the formation of any definite conclusions. The procedure was the same as in 1930. Dusts were not so satisfactory as sprays, largely owing to weather conditions, and a power duster did not give as good coverage as the hand duster used in the previous year. Seven sprays of a commercial brand of barium fluosilicate and sulphur reduced the percentage of infestation by *Cydia molesta* from 13 on untreated trees to 7·9, and by *Conotrachelus nenuphar* from 10·3 to 2·5; 4 sprays and 1 dust of barium fluosilicate, talc and sulphur gave almost as good results, and 4 sprays of cryolite and sulphur also proved satisfactory. The results of both years show that a marked degree of control may be obtained by the application of 5–6 or more sprays or dusts of the fluorine compounds, but as they are only preliminary, the continuation of the old spray programme is advised.

Investigations on the period of emergence of *C. nenuphar* from hibernation, which, in 1930, lasted from about 10th April to 12th June, the peak occurring on 19th April, indicated that the application of a "petal fall" spray is unnecessary in Tennessee in normal years, those in which it should be applied being determined by jarring the trees.

The application of 2–3 sprays, commencing with the " shuck " spray, are recommended against the overwintered adults and 2–3 pre-harvest sprays against the adults of the first brood.

BEAL (J. A.). **Control of the Turpentine Borer in the Naval Stores Region.**—*Circ. U. S. Dept. Agric.*, no. 226, 18 pp., 14 figs., 4 refs. Washington, D.C., July 1932. [Recd. December 1932.]

With the improved methods of obtaining turpentine, by which the trees are worked for a longer period, their protection from injurious insects has become of greater significance. The principal damage is caused by *Buprestis apricans*, Hbst. (turpentine borer), which attacks both the long-leaf pine (*Pinus palustris*) and the slash pine (*P. caribaea*) and occurs throughout the entire range of these trees in the south-eastern United States. The adults hibernate in the pupal cells $\frac{1}{4}$–$\frac{1}{2}$ inch below the cut surface (face) from which turpentine has been collected. Emergence occurs during the first warm days of spring (late February and early March). In a locality in Florida, it lasted about 3 weeks during 1928 and 1929, most of the adults appearing within the first 2–3 days. The adults feed on the foliage, the damage they do being of minor significance. The eggs are laid in cracks or in exposed wood on burned or dry faces and hatch in a few days. The larvae enter the wood, in which they bore tunnels $\frac{1}{4}$–$\frac{1}{2}$ inch in diameter and of an average length of 21 inches, as many as 25–50 larvae often being found in an area 2–3 feet in length. Their activity causes a copious flow of resin about the injuries, and the surrounding wood becomes heavily impregnated with it. The greatest injury occurs in a band of rings where the sapwood and heartwood meet.

The heaviest losses result from the breaking of the trees in storms. Investigations revealed that *B. apricans* contributed to the fall of 87 per cent. of the trees blown down by wind, 81 per cent. of which broke between the top of the face and the box or gutter insertion, which is usually the point of greatest infestation. Loss is also experienced from a lowering of the value of timber from infested trees, and in a reduction in the amount of gum produced, especially in thin-sap slash pine. *Pinus taeda*, when injured, is also infested, but as this tree is not worked for turpentine, the damage to it is limited.

Extensive observation showed that infestation may be prevented to a large extent by the adoption of relatively narrow faces and shallow chipping (especially at the peak), which results in a reduction in the percentage of dry faces, careful scraping so as not to remove any of the wood, and the use of nails or tacks rather than incisions in the wood to fasten the tins. It is necessary to keep a coating of gum continually over the faces for the prevention of oviposition.

CHAMPLAIN (A. B.) & KNULL (J. N.). **Fermenting Baits for Trapping Elateridae and Cerambycidae (Coleop.).**—*Ent. News.*, xliii, no. 10, pp. 253–257, 2 refs. Philadelphia, Pa., December 1932.

A list is given of some of the Coleoptera captured in the last 5 years in Pennsylvania by means of fermenting liquid baits. Elaterids and Longicorns were most readily attracted by the use of a mixture of the better grades of molasses and water (1 : 10), which remained attractive to them up to the time of putrefaction [*cf. R.A.E.*, A, xviii, 74]. The most effective containers were agate-ware pans capable of holding 2 U.S. quarts, which were hung 4–6 ft. from the ground on the branches of trees.

Hutson (R.). **A new Pest on Raspberry.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 2, pp. 68–70, 2 figs. East Lansing, Mich., November 1932.

Injury to red raspberry canes observed at East Lansing, Michigan, in 1931 and again in July 1932, when 35–50 per cent. of the canes were broken off at various distances from the ground, was found to be due to a Buprestid tentatively identified as *Agrilus communis* var. *rubicola*, Abeille [*cf. R.A.E.*, A, xx, 408]. The same species was also bred from *Rosa rugosa* growing in the vicinity in 1931. The injury was found to be caused by spiral burrowing in the wood by larvae hatching from eggs laid on the surface of the bark. The cambium layer had been destroyed, as well as much of the woody supporting tissue of the cane, causing the breakage of the canes. Galls are formed similar to those caused by the red-necked cane-borer [*A. ruficollis*, F.] except that they occur in any part of the cane instead of being confined to the vicinity of a leaf axil; the larvae when found were in the gall or above it. A considerable percentage of samples of raspberry canes received from other parts of the State, particularly from the east and south, have shown the work of this borer. A spray of lead arsenate would probably reduce infestation, and cutting out of galled canes would kill enough hibernating larvae to afford a good percentage of control. It appears that planting *Rosa rugosa* in the neighbourhood of raspberry canes is likely to result in the infestation of the latter.

Pettit (R. H.). **The Potato Tuber Moth.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 2, pp. 70–72, 2 figs., 2 refs. East Lansing, Mich., November 1932.

During late August 1932, it was discovered that thousands of barrels of potatoes that had been shipped from Virginia into Michigan were infested with *Phthorimaea operculella*, Zell., and a vigorous campaign was instituted to recover such as had already been distributed. In view of the infestation that is likely to occur, brief notes, taken from the literature [*R.A.E.*, A, v, 433; xx, 522], are given on the habits and control of the moth, to which the dry, hot climates of Florida, Texas and California have proved particularly favourable. The number of generations in Michigan would probably be somewhat fewer than in California, where there are five and the growing season is longer, since no development takes place below 50°F. Injury to the top of the potato plant is slight in comparison with that caused in the tubers. All stages of the moth, which are able to withstand comparatively low temperatures in storage, would be protected from the effects of cold, as potatoes are stored at temperatures above freezing. Preventive and control measures previously recommended [v, 433] are quoted; they include deep planting and cultivation; early harvesting before the potato tops become dry, causing the larvae to enter the tubers; prompt closing and removal from the field of sacks of potatoes; and destruction of discarded potatoes within two weeks.

Person (H. L.). **Theory in Explanation of the Selection of certain Trees by the Western Pine Beetle.**—*J. For.*, xxix, pp. 696–699, 3 refs. Washington, D.C., 1931.

It is known that the western yellow pine (*Pinus ponderosa*) is more likely to be killed by *Dendroctonus brevicomis*, Lec., than any other

trees. In 1928–30 investigations were made in California on the causes of the attractiveness of certain trees. The conclusions were based on four more or less distinct phases of study, *viz.* : the oleoresins of *Pinus ponderosa* (which appeared to have no relation to attractiveness) ; the biology of some micro-organisms associated with *D. brevicomis* ; the chemistry and physiology of certain sugars of the inner, living bark ; and experiments in which the comparative attractiveness of a great number of substances was tested on caged beetles as a check on the other parts of the study.

As a result it is thought that the initial attraction of beetles to a tree is due to the formation and escape of volatile aldehydes or esters which are a by-product of a respiratory fermentation resulting from abnormal enzyme activity in subnormal trees. The causes of this structural condition include drought and injuries of various kinds. In only slightly subnormal trees this attraction is probably only detected by beetles in the immediate vicinity, but after a few attacks are made, a second stronger attraction is started by the yeast introduced by the beetles and growing in the inner bark. This is probably strong enough to attract beetles from a considerable distance, with the result that the tree is usually heavily attacked and killed. Further studies on this theory are being carried out. Its value lies in its application to forest management, making it possible to reduce loss by leaving on cut-over areas only such trees as will have the best chance of surviving until the next cut. The logging programme may also be planned with a view to cutting certain heavily infested areas earlier so as to reduce insect loss.

Craighead (F. C.), Miller (J. M.), Evenden (J. C.) & Keen (F. P.). **Control Work against Bark Beetles in western Forests and an Appraisal of its Results.**—*J. For.*, xxix, pp. 1001–1018. Washington, D.C., 1931.

Up to 1930 approximately £200,000 (at par) has been expended in the control of outbreaks of pine bark-beetles of the genus *Dendroctonus* in the United States, and it seems desirable to review the results obtained by this expenditure. A short abstract is given of the projects undertaken during the last 30 years against the different species, the one outstanding conclusion of their analysis being that each presents an individual problem, which may also vary in different regions.

Britton (W. E.). **Some prevalent Insect Pests of Shade Trees.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 41–44. Yonkers, N.Y., 1931. [Recd. December 1932.]

Brief notes are given on the prevalence of some of the insect pests of shade trees in the north-eastern United States during 1931.

Middleton (W.). **The Susceptibility of Shade Trees to Insects.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 46–54, 4 refs. Yonkers, N.Y., 1931. [Recd. December 1932.]

Lists are given of various shade trees and shrubs arranged according to the numbers of enquiries received by the United States Bureau of Entomology during the past $4\frac{1}{2}$ years as to the control of insects attacking them, by which it is suggested that their relative susceptibility to infestation may be judged. The insects concerned are also recorded in a similar list.

FRIEND (R. B.). **The European Pine Shoot Moth.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 56–59. Yonkers, N.Y., 1931. [Recd. December 1932.]

Notes are given on the bionomics and control of *Rhyacionia buoliana*, Schiff., on pines in Connecticut, some of the information being similar to that already noticed [*R.A.E.*, A, xix, 652 ; xx, 650]. The adults oviposit in late June or early July, and the larvae hatch during the latter month and feed inside the buds or externally on the apical parts of the current year's growth. They hibernate in the buds and continue feeding on the developing buds in the spring. Pupation takes place in the new shoots during May.

YOUNG (H. C.). **A new Spray Material for Shade Trees.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 86–87. Yonkers, N.Y., 1931. [Recd. December 1932.]

The author records the successful manufacture on a commercial scale of hydrophilic colloidal sulphur, which gave excellent control of fungi, mites and thrips when used on apples and hothouse tomatos at the rate of 3 lb. and 4 lb. material to 100 U.S. gals. respectively. No injury was caused to apple foliage when it was mixed with summer oils and it also combines satisfactorily with lead arsenate and fluosilicates.

COLLINS (C. W.). **Parasite Introductions for the Gipsy Moth and some other Forest and Shade-tree Insects.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 129–131. Yonkers, N.Y., 1931. [Recd. December 1932.]

The situation as regards the introduction and liberation in the United States of parasites of the gipsy moth [*Porthetria dispar*, L.] and other introduced Lepidoptera and sawflies is briefly reviewed.

HOUSER (J. S.). **Insect Conditions in Ohio.**—*Proc. 7th Nat. Shade Tree Conf.*, p. 131. Yonkers, N.Y., 1931. [Recd. December 1932.]

Satisfactory results were obtained in the control of a mite differing slightly from the common conifer mite [*Paratetranychus ununguis*, Jac.], an outbreak of which occurred on boxwood [*Buxus*] in Ohio in the spring of 1931, by the application of a spray of 10 lb. glue in 100 U.S. gals. water, with the addition of dry lime-sulphur or colloidal sulphur. This mite chiefly feeds on the lower surface of the leaves, which become lighter in colour.

TURNER (N.). **The Catalpa Mealybug.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 132–133. Yonkers, N.Y., 1931. [Recd. December 1932.]

Pseudococcus comstocki, Kuw. (catalpa mealybug) [*R.A.E.*, A, xiii, 567] is a serious pest of *Catalpa speciosa* in streets in New Haven, Connecticut, but in 1930, despite the dry conditions, no great damage was caused, though a few leaves dropped prematurely and some galls were formed on young branches, especially where the bark had suffered mechanical injury. In 1931, the overwintered eggs began hatching on 20th May, the accumulated egg masses being 1 in. thick in some cases, and the majority of larvae had appeared by 10th June. Eggs of the next generation were hatching on 27th July, and most of the mealybugs were about half-grown on 24th August.

Spraying with 0·5 per cent. nicotine sulphate (40 per cent.) and 1 per cent. liquid soap during the latter half of June gave good control of the young larvae and may also be effective early in August against those of the next generation. Sprays for the control of the overwintering eggs would not be successful unless preceded by a thorough scrubbing of the trees to remove the thick egg masses [*cf.* xiv, 78].

MUESEBECK (C. F. W.). **Correction.**—*Proc. Ent. Soc. Wash.*, xxxiv (1932), no. 9, p. 158. Washington, D.C., 23rd January 1933.

The food-plant of *Harmolita opuntiae*, Mues., is stated to be *Hilaria mutica* and not *Opuntia spinosior* as recorded when this Eurytomid was described [*R.A.E.*, A, xxi, 17].

JONES (H. A.). **The Rotenone Content of Derris Root, Cube Root and other Plant Materials.**—*J. Wash. Acad. Sci.*, xxiii, no. 1, pp. 36–46, 14 refs. Menasha, Wis., 15th January 1933.

The results are given of the extraction of rotenone, by means of carbon tetrachloride and of ether, from roots of *Derris* (*Deguelia*), cubé (*Lonchocarpus nicou*) and other plants of the latter genus. The rotenone content of 45 samples of derris root varied from 0 to about 7 per cent., while that of 23 samples of cubé root ranged from less than 1 to about 11 per cent., indicating the desirability of cubé root as a source of rotenone and of its more extensive cultivation. By selection of high rotenone strains of derris, its rotenone content could probably be improved. A close correlation existed between the rotenone content and the total extractive materials of cubé root, whereas there was little or no correlation between these two values in the case of the derris root samples. Fine derris roots had a slightly higher rotenone content than coarse ones. The stem parts of both derris and cubé should be investigated for their rotenone content, as it is possible that they contain sufficient rotenone to justify harvesting the whole plant rather than the roots only. Of other species of *Lonchocarpus* tested, Brazilian timbo root may afford an additional source of rotenone.

CLAUSEN (C. P.). **The Biology of *Encyrtus infidus* Rossi, a Parasite of *Lecanium kunoensis* Kuw. (Hymen.).**—*Ann. Ent. Soc. Amer.*, xxv, no. 4, pp. 670–687, 5 figs., 6 refs. Columbus, Ohio, December 1932.

Encyrtus infidus, Rossi, a parasite of *Lecanium kunoensis*, Kuw., the most common and injurious of the Lecaniine Coccids attacking cherry in Korea, produces two generations and a partial third each year upon one generation of the host. A detailed account based exclusively on studies made on the second generation in 1923 and 1924, and verified in 1928, is given of the complex interrelationships of the parasite and host, and the immature stages of the former are described. Particular attention is paid to the manner of respiration of the late larval and pupal stages, which is unusual in that the air supply is derived from the tracheal system of the host by direct connection. The Coccid hibernates in the early larval stages and matures early in May, oviposition taking place during the latter part of that month and early June. The adults of the first, or overwintering, generation of *E. infidus* emerge from the young host scales about 15th April, attaining their maximum numbers about the end of the month. The last female was observed on 21st May in 1923 and on 15th May in 1928. In 1928, 82

per cent. of a total of 700 adults of the second brood emerged between 1st and 5th June, at which time a small proportion of the Coccids had not yet deposited eggs. A partial third generation of the parasite was produced in these females. The females of this brood, as well as most of those of the second, await the development of the young scales, in which they oviposit during the summer and early autumn. The larvae hatching from these eggs overwinter within the host. The hibernating generation of *E. infidus* kills its host before it is able to reproduce, but only 6 per cent. of the host scales were killed by the second generation without ovipositing, egg deposition being about 50 per cent. of the normal among all parasitised scales in spite of the fact that on an average 6·4 Encyrtid adults were produced from each. Oviposition frequently continued up to the day of emergence of the first adult parasite, which caused death by mechanical injury.

The percentage of parasitism by the first generation of *E. infidus* was approximately 20, only one parasite emerging from each host, whereas the corresponding figures for the second and partial third generations were about 90 and 100 respectively. If the second generation matured two weeks earlier, only an occasional host scale would be able to deposit eggs, but under present conditions, the high numerical level of the parasite has relatively little significance in restricting the reproduction of the Coccid. In the generation emerging during the first week in June, the ratio of females to males was 1 : 1·1, this preponderance of males, though slight, being quite unusual in the family. Oviposition records for 15 mated females gave a general average of 140 eggs during a period of nearly a month. Rearing experiments with unmated females resulted in the production of male progeny only.

Under field conditions the percentage of parasitism of *L. kunoensis* by *E. infidus* is so high as to give rise to very extensive superparasitism. When the available food supply is insufficient, the younger larvae die of starvation. Pupation occurs within the last larval skin which is still surrounded by the body fluids of the living host, and the adult emerges irrespective of the presence of other individuals or of the physical condition of the host. Multiple parasitism was of frequent occurrence, the other parasites involved being two Encyrtids of similar general habits, though lacking the respiratory modifications of *E. infidus*. A pronounced interspecific tolerance exists, but *E. infidus* generally dominates as a result of slightly earlier time of appearance and oviposition.

PLUMMER (C. C.) & LANDIS (B. J.). **Records of some Insects predacious on *Epilachna corrupta* Muls. in Mexico.**—*Ann. Ent. Soc. Amer.*, xxv, no. 4, pp. 695–708, 1 fig. Columbus, Ohio, December 1932.

Efforts were made to induce a number of Rhynchota and a few Coleoptera found in Mexico in the summer of 1930 in association with *Epilachna corrupta*, Muls., and other species of the same genus to feed on the immature stages of *E. corrupta* in the laboratory. In all 21 species were found to feed on the bean beetle, several of them consuming large numbers. The method employed in collecting the insects and in collating the value of the several species of predators on the basis of the amount of food they consume is described, and the results are discussed. Brief notes on their biology are also included.

The insects that appeared most likely to be of value as natural enemies of *E. corrupta* were Pentatomids, particularly *Podisus sagitta*, F., and *Apateticus* (*P.*) *lineolatus*, H.-S., though the relative prevalence of the different species varied with the locality. As, however, their life-cycle is several days longer than that of *E. corrupta*, the larval population of the latter reaches its maximum and damage to bean foliage is accomplished before they appear in appreciable numbers. Moreover, the winter survival of the Coccinellid in most parts of the infested areas of Mexico is high, so that it is probable that the activity of predators during the late summer does not reduce its numbers below that necessary to maintain it in the following season.

Bissell (T. L.). **The Identity of the Black Pecan Aphid,** *Melanocallis caryaefoliae* (**Davis**).—*Ann. Ent. Soc. Amer.*, xxv, no. 4, pp. 730–735, 6 figs., 7 refs. Columbus, Ohio, December 1932.

A. C. Baker [*R.A.E.*, A, v, 494] considered *Callipterus caryaefoliae*, Davis, described from hickory in Illinois and Missouri, to be a synonym of *Myzocallis* (*Aphis*) *fumipennellus*, Fitch. Hottes and Frison [xx, 16] agreed with this view but referred the species to the genus *Melanocallis*. This is the name to which the black pecan aphis common in the southern United States has been referred. From an examination of the types, the author redescribes *fumipennellus* and gives notes on *Melanocallis caryaefoliae*, and on the characters and status of the genus *Melanocallis*, showing that *M. caryaefoliae*, which is the genotype, is a distinct species, and the one known as the pest of pecan. As *fumipennellus* is known only from the imperfect type specimen, its exact generic position is uncertain.

Gahan (A. B.). **Miscellaneous Descriptions and Notes on parasitic Hymenoptera.**—*Ann. Ent. Soc. Amer.*, xxv, no. 4, pp. 736–757. Columbus, Ohio, December 1932.

New species described include *Diaretus oregmae*, which was taken ovipositing in *Oregma lanigera*, Zehnt., on sugar-cane in the Philippines; *Tumidiscapus orchelimumis*, which has been reared from eggs of *Orchelimum vulgare*, Harr., in Illinois and recorded as *T. flavus*, Gir. [*R.A.E.*, A, xviii, 391]; *Tetrastichus oncideridis*, reared from *Oncideres cingulata*, Say, in West Virginia; *Thripoctenus vinctus*, reared from *Taeniothrips longistylus*, Karny, and *T. femoratus*, collected on bean flowers infested with this thrips, both in the Philippines; *Cirrospilus ingenuus*, reared from *Phyllocnistis citrella*, Staint., in Java; and *Gonatocerus capitatus*, from eggs of *Eutettix tenella*, Baker, in Utah.

Species the synonymy of which is discussed include: *Antrocephalus* (*Haltichella*) *stokesi*, Crwf. (*pomonellae*, Cam.), *Amblymerus* (*Pteromalus*) *verditer*, Nort. (*Nasonia tortricis*, Brues), and *Prospaltella tristis*, Zehnt. (*Aspidiotiphagus aleyrodis*, Ashm.).

Daviault (L.). **La pyrale des pousses de pin dans la Province de Québec.** *Rhyacionia* (*Evetria*) *frustrana* **Comstock. Pine Shoot Moth.**—*Nat. canad.*, lix, no. 10, pp. 185–188, 4 refs. Quebec, October 1932.

Rhyacionia frustrana, Comst., is recorded from the Province of Quebec as damaging a plantation of pine and spruce planted during 1914–25. *Pinus resinosa* and *P. sylvestris* were chiefly attacked, and *P. strobus*, *P. montana* and *Picea excelsa* suffered to a less extent.

There is one generation a year in Quebec, hibernation occurring in the pupal stage in cocoons attached to the trees or under débris on the ground [*cf. R.A.E.*, A, xviii, 319, 392]. The adults emerge in the first fine days of spring, and the eggs are laid singly or in groups of 2 or 3 on the needles or buds. The larvae hatch in 10–15 days and, after making protective webs, at once begin to feed on the young shoots, later on making their way into the stalks or buds, which they leave only to pupate. Infested shoots become withered and discoloured and when abandoned by the larvae are further damaged by weevils.

Lesne (P.). **Notes sur les Coléoptères térédiles. 22. Diagnosis de Bostrychides nouveaux de l'Asie orientale.**—*Bull. Mus. Hist. nat.*, (2) iv, no. 6, pp. 651–663, 1 fig. Paris, October 1932.

Among the new Bostrychids described are *Stephanopachys himalayanus*, found in the bark of *Pinus longifolia* in the Punjab, *Sinoxylon eucerum*, which is a serious pest in Central China, mining the woody stems of vines in full vigour, and *Xylion bifer*, infesting the wood of teak (*Tectona grandis*) in Madras, and also occurring in Tenasserim and Java.

Kinoshita (S.) & Kawada (A.). **A Revision of Rice Borers** (*Chilo*) **and their Distribution.** [*In Japanese.*]—*J. Imp. Agric. Expt. Sta. Japan*, ii, no. 1, pp. 97–104, 11 refs., 1 fig., 1 pl. Nisigahara, Tokyo, March 1932. (With a Summary in English.) [Recd. December 1932.]

Descriptions are given of the distinguishing characters of the mature larvae, pupae and male adults of *Chilo zonellus*, Swinh., and *C. simplex*, Butl., of which *C. oryzae*, Fletcher, is considered a synonym [*R.A.E.*, A, xviii, 615]. Examination of various stages of rice borers from different localities showed *C. zonellus* to occur only in India, and *C. simplex* in Japan, including Hokkaido, the Loochoo Islands, Korea, Formosa, South China, the Philippines, Java, India, Burma and Hawaii, and probably also in Malaya, Siam and Indo-China. It appears to be most numerous in the temperate regions between annual isotherms of 6 and 17°C. [42·8 and 62·6°F.], and in the subtropical region (Formosa), its numbers tend to decrease towards the south. It is thought that another species of rice borer is also present in Java, the systematic position of which requires further investigation.

Atalla (J.) & Hassibi (S.). **Bulletin de l'Office International de Renseignements sur les Sauterelles de Damas. Années 1930 et 1931.**—Med. 8vo, 264 pp., 1 pl., 2 maps. Damascus [1933].

The International Office for Locust Intelligence was formed at Damascus in 1927 by an agreement between Turkey, Iraq, Palestine, Syria and Transjordan, for the purpose of collecting information on locust movements in each of these countries and transmitting it to the others. The present first publication contains a collection of detailed reports on the course of locust outbreaks, the organisation and technique of locust control, the expenditure involved under various headings, and the damage caused by locusts in 1930 and 1931 in the countries concerned.

Two species of locusts are of economic importance in south-western Asia. One is *Schistocerca gregaria*, Forsk., invasions of which occurred

in 1865, 1878, 1902, 1915 and 1929–1931. The centre from which these come is in the Arabian peninsula, and the region of Wadi Serhan is regarded as particularly important in this respect. The other species is *Dociostaurus maroccanus*, Thnb., which has its permanent breeding area in the Jezireh region, between the Tigris and Euphrates, limited by latitudes 36° and 37°N.

The life-histories of both species are briefly described, and the laws relating to locust control in the associated countries are reproduced in full.

Betrem (J. G.). **Witte luis in Besoeki en Djember.** [Mealybugs in Besoeki and Djember, Java.]—*Bergcultures*, vi, no. 44, pp. 1178–1185, 5 figs. Batavia, 1932.

The information in this paper on mealybugs attacking coffee in Java is similar to that in one already noticed [*R.A.E.*, A, xx, 599], but the unidentified species of *Pseudococcus* is now recorded as *P. deceptor*, Green (M.S.).

Miller (N. C. E.). **A Preliminary List of some Food-plants of some Malayan Insects.**—*Bull. F.M.S. & S.S. Dept. Agric.*, no. 38 Suppl., 54 pp. Kuala Lumpur, 25th November 1932.

This supplement follows the arrangement of the original bulletin [*R.A.E.*, A, xv, 131], a few errors in which are corrected, and contains the records for the years 1927–31.

Franssen (C. J. H.) & van Heurn (W. C.). **Biologie en bestrijding van de sjalottenthrips** (*Thrips tabaci* **Lindn.**). [The Biology and Control of the Onion Thrips, *T. tabaci*.]—*Korte Meded. Inst. PlZiekt.*, no. 18, 20 pp., 14 refs. Buitenzorg, 1932. (With a Summary in English.)

The following is largely taken from the authors' summary. In Java *Thrips tabaci*, Lind., occurs on several cultivated plants but does not cause serious damage except on onions in the dry season, infestation being checked by abundant rainfall. All stages are described. In the laboratory development up to the adult stage averaged 9 days, with a maximum of 12, and adult life 19 days, with a maximum of 25, during which time about 84 eggs were laid. No males have been observed in Java. The Eulophid, *Thripoctenus brui*, Vuillet, is suspected of parasitising the thrips, and it is attacked by the adults and larvae of *Coccinella repanda*, Thnb., which seems of some importance in its control. The present methods of cultivation, which result in onions being available for some six consecutive months, favour a rapid increase of infestation. No satisfactory practical results were obtained in tests of a great number of stomach and contact insecticides, and collection with hand-nets also proved unsatisfactory. Selection of the right season for planting and strict crop-rotation are advocated, the onions being planted in isolated fields wherever possible.

Hoffmann (W. E.). **The economic Status of the Genus** *Eurydema* **with biological Notes on** *E. pulchrum* **Westw. (Hemiptera, Pentatomidae).**—*Lingnan Sci. J.*, xi, no. 4, pp. 553–564, 14 refs., 1 pl. Canton, China, 15th November 1932.

Brief notes taken from the literature are given on the bionomics of various Pentatomids of the genus *Eurydema* that attack cultivated

plants. Observations were carried out in China during the spring of 1928 on *E. pulchrum*, Westw., which feeds on a variety of cruciferous vegetables, lettuce, etc., showing a preference for the fruits of these plants. It usually lays its eggs in a double row in masses of 12. In the field near Canton they were found on the stems and lower surfaces of the leaves of *Brassica alboglabra* (Chinese kale), and in the laboratory females preferred to oviposit on the lower surfaces of nearly horizontal objects. The nymphs remain clustered without feeding for 24 hours or more after hatching. It is considered that considerable mortality occurs about the middle of May, with the disappearance of the crop of *B. alboglabra*, which is the preferred food-plant. The life-cycle from egg to adult occupies 29 days in the spring, and 5 or 6 generations in a year would be possible. Descriptions of the nymphal and adult stages are quoted from a paper by Miller [*R.A.E.*, A, xix, 647].

HOFFMANN (W. E.). *Oides decempunctata* (**Billberg**), **a Chrysomelid Pest of cultivated Grape** (*Vitis lambrusca* **Linn.**).—*Lingnan Sci. J.*, xi, no. 4, pp. 565–566, 4 refs., 2 pls. Canton, China, 15th November 1932.

The Galerucid, *Oides decempunctata*, Billberg, is a serious pest of cultivated grape-vines in various localities in southern China, and has also been observed on a wild species of *Vitis* and on a vine apparently of some other genus. Additional food-plants are recorded from the literature, and the larva, pupa and adult are briefly described. Young larvae have been found on vines at Canton early in April and mature ones at the end of that month and also at the end of July. Larvae entering the soil for pupation on 29th April 1928 emerged as adults on 15th May. The adults begin to feed within 24 hours of emergence.

WANG (C. N.). **An Estimation of Damages caused by** *Schoenobius incertellus* **Wlk. and** *Chilo simplex* **Butl. in the Lin-Ping District, Chekiang.** [*In Chinese.*]—*Tech. Bull. Bur. Ent. Phytopath. Hangchow China*, no. 1. 1931. (Abstract in *Lingnan Sci. J.*, xi, no. 4, p. 600. Canton, China, 15th November 1932.)

Infestation of rice by *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) and *Chilo simplex*, Butl., was reduced by the use of light traps from 2·04 to 0·77 per cent. The larvae were found in 48 per cent. of the white heads or panicles collected. Individual plants were severely infested by *C. simplex*, 118 larvae being observed in one, whereas *S. bipunctifer* was evenly distributed in the field, not more than 3 larvae being usually present in each plant. The larvae of both species hibernated in the first four nodes from the base.

KOIDSUMI (K.). **Experimental Studies on the Influence of low Temperatures upon the Development of Fruit-flies. Second Report.** [*In Japanese.*]—*J. Soc. Trop. Agric.*, iv, no. 3, pp. 322–359, 2 graphs, refs. Formosa, October 1932. (With a Summary in English.)

This further report [*cf. R.A.E.*, A, xx, 80] deals with the effect of extremely low temperatures on the pupae and larvae of *Dacus* (*Chaetodacus*) *cucurbitae*, Coq.

The following is taken from the author's summary. No adults were obtained from pupae exposed for 80–96 hours at −1°C. [30·2°F.], 20–52 hours at from −2 to −3°C. [28·4–26·6°F.], 4–8 hours at −4 to

−5°C. [24·8–23·0°F.], 2–4 hours at −6 to −7°C. [21·2–19·4°F.] or 1½–2 hours at −8 to −12°C. [17·6–10·4°F.]. In the case of the larvae the minimum time required to obtain 100 per cent. mortality was 84–96 hours at −1°C., 20–56 hours at −2 to −3°C., 3–10 hours at −4 to −5°C., 2–4½ hours at −6 to −7°C. and 1½–2 hours at −8 to −12°C. As in the previous experiments [*loc. cit.*] the larvae were more resistant to low temperature than the pupae.

Veitch (R.). **Report of the Chief Entomologist.**—*Ann. Rep. Dept. Agric. Queensland, 1931–32*, pp. 51–55. Brisbane, 1932.

The scarcity of *Dacus ferrugineus*, F. (*Chaetodacus tryoni*, Frogg.) in the Stanthorpe district of Queensland during the year 1931–32 is attributed chiefly to increased care in orchard sanitation, the destruction of the adults by baits, and the occurrence of unfavourable climatic conditions. The position is not so satisfactory in the south-eastern and coastal districts, which are, however, of less importance as deciduous fruit-growing areas. Large numbers of trees in gardens afford host-fruits for the breeding of enormous quantities of flies, the progeny of which subsequently migrate to commercial orchards. The loss experienced in the main *Citrus* districts was small. *Cydia pomonella*, L. (codling moth) was considerably less abundant than usual, appreciable losses being comparatively few. In the majority of cases *Eriosoma lanigerum*, Hausm. (woolly apple aphis) was controlled by *Aphelinus mali*, Hald. [*cf. R.A.E.*, A, xx, 156], and the position as regards *Aspidiotus perniciosus*, Comst. (San José scale) has greatly improved.

Calandra oryzae, L. (rice weevil) was found attacking apples in the field and in the packing sheds in the Stanthorpe district. Eggs were laid in the fruit, but though the larvae apparently reach maturity, no pupae were found in the fruit. The larvae penetrate to the centre of the apple, the tissue of which breaks down as a result of storage rots, and the larvae perish. Infested grain should be removed from the packing sheds, as infestation of apples was invariably found to have originated in the grain. Serious damage was caused in certain orchards to a number of buds and young shoots of apple grafts by a species of *Myllocerus*. In this connection it is reported that *M. multimaculatus*, Lea, was recorded as attacking the foliage of apricots in large numbers in one district in 1921. The blossoms of vines and the young grapes were attacked by the Galerucid, *Monolepta divisa*, Blkb., and the foliage in one vineyard by the larvae of the Psychid, *Hyalarcta huebneri*, Westw. Further evidence was obtained as to the benefit resulting from soil fumigation with paradichlorobenzene against *Decilaus citriperda*, Tryon (citrus root bark channeller) [*loc. cit.*], but additional information on its biology is necessary before satisfactory control measures can be developed. A leaf-eating weevil, provisionally identified as *Onesorus* sp., was fairly abundant on tobacco in one area in January, but it is not considered of any great importance and its incidence will probably be somewhat sporadic. Unusually heavy damage was caused to bananas by *Scirtothrips signipennis*, Bagn., rendering the fruit unmarketable or lowering its value. The Noctuid, *Antarchaea chionosticta*, Turn., is recorded as a pest of cotton; the larvae destroy almost the whole of the tissue of the soft, young foliage, and also cause extensive injury to the terminals and destroy many of the small squares on them. Though large squares are also attacked, no

injury to the bolls has been observed. In one district cabbage was severely infested by *Plutella maculipennis*, Curt., *Heliothis obsoleta*, F., and *Hellula undalis*, F. Unsatisfactory stands of wheat in a number of fields in April were due to the activities of *Pheidole ampla*, For.; the ants heap swollen, ungerminated grains in masses of 50 or more a few inches below the soil, many becoming affected by moulds. Investigation indicated that good results would be obtained by planting when moisture conditions would result in the rapid germination of the seeds. Damage to wheat by earwigs has been reported from a district in which maize had been attacked by *Nala lividipes*, Dufour, in 1929, injury being caused to the seed, the stems of the seedlings and the roots.

STOREY (H. H.). **Report of the Plant Pathologist.**—*4th Ann. Rep. Amani East Afr. Agric. Res. Sta. 1931–32*, pp. 8–13. London, H.M.S.O., 1932.

Investigations on the relation between insects and virus diseases in Africa showed that in addition to *Cicadulina mbila*, Naudé, *C. zeae*, China, is a vector of streak disease of maize, and that the Delphacid, *Peregrinus maidis*, Ashm., transmits a rather similar disease occurring in the Amani district, the virus of which may be identical with that of "corn stripe" in Cuba [*R.A.E.*, A, xvii, 420]. *C. mbila* is unable to transmit this new virus and *Peregrinus* is unable to carry that of common streak disease. Races of *C. zeae* that are unable to transmit the latter have been reared experimentally [*cf.* xx, 717]. Attempts to transmit leaf-curl of tobacco to cotton were unsuccessful, although the types of leaf-curl affecting the two plants are rather similar and the vector of each disease is a species of *Bemisia* [xx, 330]. Leaf-curl of tobacco appears to be widely distributed in Africa, being recorded from Zanzibar, the Transvaal, Southern Rhodesia, Nyasaland and the Belgian Congo, and a similar disease has been reported from Java [xx, 381].

The presence in Uganda of a rosette disease of groundnuts [*Arachis hypogaea*] similar to that occurring in South Africa [xv, 569] was confirmed in 1931, and experiments proved that it might be transmitted by *Aphis laburni*, Kalt. (*leguminosae*, Theo.). The disease appeared to be less severe in closely-planted areas and where the soil had been mulched with grass after sowing, and it is suggested that the resulting conditions were unfavourable to the Aphids. Unsuccessful attempts have been made at Amani to transmit the virus to a number of other leguminous plants.

RITCHIE (A. H.). **Report of the Entomologist, 1931.**—*Ann. Rep. Dept. Agric. Tanganyika Terr. 1931*, pp. 83–86. Dar-es-Salaam, 1932.

Owing to the heat and lack of rainfall from September to November of 1931, coffee in Tanganyika Territory was seriously affected by *Physothrips xanthocerus*, Hood, and *Retithrips aegyptiacus*, Marchal, though the latter species was ultimately brought under control by an internal parasite. Sprays recommended as a result of field trials are lime-sulphur, 1 : 60; lime-sulphur 1 : 80, with the addition of 1 lb. calcium caseinate, and ½ pint 40 per cent. nicotine sulphate to each 100 gals.; or, as a combined spray against *Hemeleia* and thrips in February–March, Bordeaux mixture, 1–1–10, with 1 oz. nicotine sulphate and 1 lb. fish-oil soap. Parasites reared from coffee pests included *Elasmus* sp., *Eulophus* sp., *Atoposoma variegatum* var. *afra*, Silv., and *Pleurotropis*

sp. from *Leucoptera coffeella*, Guér., which was numerous in districts exposed to wind, which interfered with their activity; *Coccophagus pulvinariae*, Comp., which was the most important, *C. nubes*, Comp., and *Tetrastichus gravans*, Silv., from *Coccus* (*Lecanium*) *viridis*, Green; and *Anagyrus aurantifrons*, Comp., and less frequently *Achrysopophagus* sp., and *Prochiloneurus* sp., from *Pseudococcus perniciosus*, Newst. & Willc., which they keep under effective control. Investigations showed that though *Microphanurus truncativentris*, Dodd, and *Hadronotus antestiae*, Dodd, the egg parasites of *Antestia lineaticollis*, Stål, were present everywhere, they could not exercise control. It was found that the sweetened sodium arsenite bait-spray used against the bug [*R.A.E.*, A, xix, 413] does not cause economic damage to coffee if applied in a fine mist directed upwards, the minimum quantity per tree being one fl. oz. The Hispid that was very injurious to coffee in 1927–28 [xvii, 482] has been determined as *Dactylispa hirsuta*, Gerst.

Lepidoptera attacking maize were *Marasmia trapezalis*, Gn., *Busseola fusca*, Fuller, which was parasitised by *Chasmias glaucopterus*, Morl., and *Diatraea argyrolepida*, Hmps., which was attacked by two Ichneumonids of the genus *Syzeuctus*.

Cruciferous crops were severely infested by *Plutella maculipennis*, Curt. On *Citrus*, *Lepidosaphes beckii*, Newm., is being satisfactorily controlled in Upper Usa by the fungi, *Nectria tuberculariae*, *Podonectria coccicola* and *Myriangium duriaei*.

Harris (W. V.). **Report of the Assistant Entomologist.**—*Ann. Rep. Dept. Agric. Tanganyika Terr. 1931*, pp. 87–93. Dar-es-Salaam, 1932.

Insects recorded on coffee foliage in Tanganyika Territory during 1931 included *Metadrepana* sp., the Tingid, *Habrochila placida*, Horv., which occurred in clusters on the lower surface of the leaves in dense shade, the Halticid, *Jamesonia testacea*, Wse., and an unidentified Psychid. An outbreak of the grasshopper, *Eupropacris uniformis*, Ramme, occurred in Dabaga, considerable damage being caused in a plantation of young coffee. Seedlings and newly set-out plants were successfully protected from the attacks of white grubs by placing a teaspoonful of paradichlorobenzene in each of three holes round each plant at a distance of 8 ins. from the stem.

A list is given of the insects found on tea, none of which was of serious economic importance.

Pests of cotton included the Sphingid, *Hippotion celerio*, L., which defoliated young plants in the early part of the season, the Tettigoniids, *Phaneroptera nana*, Fieb., and *Poecilogramma striatifemur*, Karsch, the Nymphalid, *Acraea insignis*, Dist., the Pentatomids, *Dalsira costalis*, Germ., and *Aeschrus inaequalis*, Spin., the Coreids, *Mirperus jaculus*, Thunb., and *Cletus ochraceus*, H.-S., and the Lygaeid, *Graptostethus servus*, F. In the Morogoro district larvae of *Platyedra gossypiella*, Saund., and *Earias* were present in May, but the peak of the infestation by the former occurred in September and October; in the Lake Victoria basin *Earias* was the chief bollworm, though less injurious to mature bolls than *P. gossypiella* in the coastal cotton areas.

Cereals in Morogoro were attacked by *Laphygma exempta*, Wlk., and an unidentified Sphingid; on the experiment station maize was to a great extent protected from the former by dusting with sodium fluosilicate and with calcium arsenate, while in other instances grass sprinkled

with sodium arsenite and placed between the rows proved effective. Sodium fluosilicate was found to injure beans when applied against the Galerucid, *Ootheca bennigseni*, Wse., and late planting is therefore recommended as an economic control measure.

A number of insects, chiefly Tenebrionids and Carabids, are recorded as preying on the hoppers of *Locusta migratoria migratorioides*, Rch. & Frm.

JAMES (H. C.). **Banding for Coffee Mealy Bug Control.**—*Bull. Dept. Agric. Kenya*, no. 24 of 1932, 6 pp. Nairobi, 1932. Price *Cts.* 25.

A brief review is given of the results of three years' work on banding for the control of ants fostering the coffee mealybug [*Pseudococcus lilacinus*, Ckll.] in Kenya [*R.A.E.*, A, xxi, 33, etc.]. Both mature larvae and adults of various predatory Coccinellids, including *Scymnus* spp. and *Hyperaspis delicatula*, Muls., may be caught in the grease bands [*cf.* xx, 669], the latter on reascending the trees after pupation. This only affects the degree of control of the mealybug by natural enemies in occasional instances where these species form the main predatory fauna of a banded area, but the use of a repellent band such as kresotow avoids this danger, and thorough tests have shown that kresotow and castor oil in equal proportions can be recommended [*loc. cit.*]. Cellophane [xix, 231 ; xx, 670] has proved to be more perishable than was expected and only remains serviceable for about a year. The application of grease direct to the bark is not advised; a preliminary coating of a commercial paint [*cf.* xxi, 33] has been used without injury to the tissues of the leaves or stems. Provided that the band is not wider than about 2 ins., 1 gal. material will be sufficient for about 3 acres of multiple stems and about 5 acres of single ones. Successive treatments should be applied to different areas of the stem in order to avoid the possibility of constriction, which might arise from the painting of one layer over another. The bark should be smoothed before the application of the paint, which should be dry before the addition of the grease. Grease has also been applied on insulating tape with success, though this method is more expensive.

Termites have proved troublesome by bridging bands of all kinds with earth or destroying the cotton wool over which some bands are applied. The fumes of burning sulphur and arsenic should be pumped into the large nests, which should be opened after several days to make certain that the queens have been destroyed. The working of paradichlorobenzene into the top layer of the soil is recommended where small nests are numerous near the surface in pieces of decaying wood or in the bases of small woody plants. Control measures should preferably be undertaken during the dry season before swarming occurs at the beginning of the rains.

JAMES (H. C.). **The Control of *Asterolecanium* (The Fringed Scale of Coffee).**—*Bull. Dept. Agric. Kenya*, no. 23 of 1932, 4 pp. Nairobi, 1932. Price *Cts.* 25.

It is considered unlikely that the natural enemies of *Asterolecanium coffeae*, Newst., will ever assume sufficient importance to control it on coffee in Kenya. The value of the internal parasite, *Metaphycus lounsburyi*, How., is reduced by the hyperparasite, *Perissopterus*

buscki, How. *Chilocorus angolensis*, Crotch, *C. discoideus*, Crotch, and *Exochomus melanocephalus*, Zoubkoff (*nigromaculatus*, Goeze) have been observed among the masses of scales and probably attack the young as they emerge from beneath the parent, the first-named having actually been observed to feed on the immature stages. These Coccinellids are seldom of great value, though their effect is more obvious on trees on which *A. coffeae* constitutes a new source of food on the disappearance of mealybugs [*Pseudococcus lilacinus*, Ckll.] as the result of banding for the control of ants that foster them.

Control of the Coccid, especially in the drier and warmer coffee-growing areas where it is most numerous, should therefore depend on thorough and frequent inspection for the early detection and treatment of incipient outbreaks [*cf. R.A.E.*, A, xvii, 627]. Infested main stems should receive two sprays of Orthol K at the rate of between 1 : 25 and 1 : 33 at an interval of 2–6 weeks. Trees that have been stumped should be scrubbed with this material (1 : 25) and then heavily white-washed. In cases of severe infestation it may be necessary to follow the spraying by severe pruning. In view of the condition of the trees with regard to dieback, it is sometimes advisable to postpone pruning until later in the dry season when the sap is moving less rapidly and the trees have recovered to some extent.

KOZLOWSKY (S.) & RUNGS (C.). **Sur quelques insectes ennemis des plantes maraichères au Maroc.**—*Bull. Soc. Sci. nat. Maroc*, xii, no. 1–3, pp. 66–68. Rabat, 1932.

Brief notes are given on the following insects attacking market garden crops in Morocco : *Scaptomyza flaveola*, Mg., on cabbage ; *Phytomyza atricornis*, Mg., on crucifers and leguminous plants ; *Anthomyia* (*Chortophila*) *radicum*, L., on radishes ; *Pegomyia hyoscyami* var. *betae*, Curt., on beet ; *P. winthemi*, Mg., on sorrel ; *Sphaeroderma ocularium* Alld., on artichoke ; *Phthorimaea operculella*, Zell., on tomato ; *Phytometra orichalcea*, F., on onion, lucerne and ornamental plants ; *Plutella maculipennis*, Curt., which attacks crucifers, and is parasitised to the extent of 50 per cent. by *Angitia plutellae*, Vier. ; and *Eriococcus cactearum*, Leon., on cultivated cactus.

DELASSUS (M.). **Algeria : The Peach Twig Borer** (*Anarsia lineatella*), **a new Parasite for the Country.**—*Int. Rev. Agric.*, xxiii, no. 12, p. M202. Rome, December 1932.

During the spring and summer of 1932 *Anarsia lineatella*, Zell., has been found attacking peach in a number of localities near Oran, Algeria.

PRIESNER (H.). **Preliminary Notes on** *Scirtothrips* **in Egypt, with Key and Catalogue of the** *Scirtothrips* **Species of the World.**—*Bull. Soc. ent. Égypte*, xvi, fasc. 3, pp. 141–155, 1 pl., 2 figs. Cairo, 1932.

The species of *Scirtothrips* occurring in Egypt, which have been determined for the first time, are *S. aurantii*, Faure, which has been found on *Acacia* and *Convolvulus*, *S. mangiferae*, sp. n., which attacks mango (*Mangifera indica*) and *Parkinsonia aculeata*, and *S. antilope*, Pr., which is of no economic importance, as it lives only on desert plants.

The adults of both sexes and larva of *S. mangiferae* are described. It appears in Upper Egypt early in March on *Parkinsonia* and probably on other plants. In the latitude of Cairo only single individuals were found on *Citrus*, but large numbers were taken on mango in April. It seems to be most abundant in June, when adults and larvae in both stages are found on the plants. Eggs are probably laid from April and May onwards in the leaf tissues. As the insects were still numerous in August there are probably several generations a year. The fact that pupae were not found on the plants suggests that pupation occurs in the soil. The thrips are found only on the young tender leaves and buds, and are very active, particularly in the adult stage. The buds are injured by sucking, and the leaf curl often observed on young mango foliage may be due to the feeding of the larvae. *S. mangiferae* is widely distributed in Egypt and has recently been discovered in cotton buds in the Sudan ; it may have been imported from some other part of Africa, or with mango trees from India.

Notes, based on the work of Hall [*R.A.E.*, A, xviii, 633, 701], are given on the bionomics and control of *S. aurantii* as a pest of *Citrus* in Southern Rhodesia. In Egypt it occurs abundantly on *Acacia arabica* var. *nilotica*, always on the leaves as both larva and adult. It is also numerous in winter on *Convolvulus arvensis*, but has never been observed on *Citrus*, its preferred food-plant being *Acacia*, which may also be its original food-plant in southern Africa [*cf.* also xviii, 241]. It has been recorded from the Transvaal, Zululand and Cape Province, where it is widely distributed, but in Egypt is only known to occur in the Cairo district and in Giza province, where it still remains harmless.

A key to the species of the genus *Scirtothrips* and a complete catalogue of them are appended.

FEYTAUD (J.). **Le pou de San José en Europe.**—*Rev. Zool. agric. appl.* xxxi, no. 8, pp. 121–123, 6 refs. Bordeaux, August 1932. [Recd. December 1932.]

Supplementing his previous paper on *Aspidiotus perniciosus*, Comst., [*R.A.E.*, A, xxi, 59], the author briefly refers to its recent establishment in Austria and Hungary [xx, 506].

AUSTIN (M. D.). **The Insect and allied Fauna of cultivated Mushrooms. I.**—*Ent. Mon. Mag.*, lxix, no. 824, pp. 16–19, 2 figs. London, January 1933.

Insects recorded as associated with cultivated mushrooms in south-eastern England in 1932 are the Mycetophilids, *Sciara agraria*, Felt, *S. vivida*, Winn., and *S. auripila*, Winn., the Phorid, *Megaselia* (*Aphiochaeta*) *albidihalteris*, Felt, *Drosophila funebris*, F., and the Collembola, *Hypogastrura armata*, Nic., with var. *inermis*, Axels., and *Proisotoma minuta*, Tullb. Of the Diptera, all of which were bred from larvae infesting mushrooms, the Mycetophilids were the most abundant, larvae being present within the stalks, gills and caps. The Collembola were found in damaged mushrooms or in the soil round them. In Kent the Braconid, *Aspilota concolor*, Nees, emerged from Dipterous pupae, particularly the Phorids, though it is possible that it oviposits on the larvae. The Diapriid, *Synacra brachialis*, Nees, was bred from Diptera in infested mushrooms collected in Sussex.

LUBATTI (O. F.). **Determination of Ethylene Oxide.**—*J. Soc. Chem. Industry*, li, no. 44, pp. 361T–367T, 2 figs. London, 28th October 1932.

The methods for determining ethylene oxide both in air spaces and in foodstuffs have become important owing to the extensive use of this substance as a fumigant for stored products. Of the two working methods, one by Müller (*Chem. Ztg.*, xliv, p. 573, 1920), based on the oxidation by chromic acid, and the other by Deckert (*Z. anal. Chem.*, lxxxii, p. 297, 1930), relying on the conversion into chlorohydrin, the latter appears to be preferable, since it is based on a specific reaction and its simplicity renders it applicable to the control of practical fumigation.

The following is the author's summary :—Experiments with the original method proposed by Deckert for the determination of ethylene oxide have been found to account for only about 90 per cent. of the substance employed. The use of a nearly saturated solution of magnesium chloride, instead of sodium chloride, has been found to give results approaching the theoretical. Comparative experiments employing various chlorides show that the solutions should contain at least 30 gm. of chlorine per 100 cc. of solution. Other halides may be used with advantage in place of chlorides, but the cost is excessive. Improved methods of handling the oxide coupled with more careful standardising of the technique of determination have resulted in closer agreement than that obtained by Deckert. This has greatly facilitated the interpretation of the results. An extension of Müller's dichromate method to the determination of ethylene oxide is described. The application of these reactions to practical tests has been studied, and a method for the determination of ethylene oxide in the control of practical fumigations has been developed.

PAGE (A. B. P.). **The Measurement of Gas Concentrations for the Control of Fumigation.**—*J. Soc. Chem. Industry*, li, no. 46, pp. 369T–374T, 2 figs. London, 11th November 1932.

The most satisfactory method for the control of commercial fumigation is the measurement of gas concentrations. Sufficient measurements must be made to give a fair idea of the distribution of gas over the whole of the space being fumigated, from the start of the fumigation to the finish. If the space contains goods or produce in boxes, bags, etc., then the concentration of gas inside these as well as outside must be measured. Other factors that increase the number of measurements necessary are draughts, irregular leaks, presence of absorptive material, irregular disposition of goods, etc. Given a satisfactory method of determining the concentration of the fumigant at any desired moment, the number of determinations is limited in practice by the time and money available and by the accuracy with which it is required to estimate the efficacy of the fumigation.

The following is the author's summary :—Experience shows the need of a satisfactory piece of apparatus for the measurement of gas concentrations. The apparatus already available is described, preference being given to the vacuum bottle. Attention is called to the defects of this in its original form. Three improved forms are described. That embodying the electromagnetic fracture of a glass septum has been found entirely satisfactory in practice and has been standardised.

Full details are given. The modification required when sampling air containing ethylene oxide is described. The actual working of the apparatus has been tested, and possible errors inherent in the vacuum method have been studied, for hydrogen cyanide and ethylene oxide. It has been shown that no corrections need be applied except when determining unusually high concentrations of hydrogen cyanide, when an "absorption error," which has been fully investigated, may become of some importance.

MUNRO (J. W.). **Infestation of Stored Products by Insects.**—*Nature*, cxxxi, no. 3299, pp. 82–84, 13 refs. London, 21st January 1933.

A brief account is given of the work that is being carried on at the laboratory of the Imperial College of Science at Slough in the study of the infestation of stored products, excluding timber, by insects. The main results of the survey work so far have been to show that in nearly all, if not all, instances infestation begins in the exporting country and is aggravated by storage in Britain. It has also served to show that close co-operation of producers, etc., is essential if freedom from infestation problems is to be attained.

It is probable that the most important contribution of the laboratory in the control of insect infestations is in directing attention to the defects in experiments on which the practice of fumigation of ships, warehouses, mills and produce is based and providing means to overcome the difficulties involved. The methods used in measuring concentrations of gases in fumigation have been described [see preceding papers]; meanwhile, two important advances in the technique have followed. A higher percentage of destruction of insects has been secured, and a more uniform distribution of the gas has been attained, even in very large warehouses in cold weather.

The final aim of the work, however, is not efficient fumigation but the reduction of infestation at its source, and while physical and chemical measures may prove palliative, it cannot be too strongly emphasised that the ultimate reduction of the losses caused by insect infestation of stored produce depends on the acquisition of a fuller knowledge of the insects concerned than is possessed at present.

MASSEE (A. M.). *Tarsonemus approximatus* **Banks var.** *narcissi* **Ewing, a Variety of Tarsonemid new to the British List.**—*Ann. Mag. Nat. Hist.*, (10) xi, no. 62, pp. 198–201, 2 figs., 1 ref. London, February 1933.

Typical *Tarsonemus approximatus*, Banks, has not been recorded in Britain, but its variety, *narcissi*, Ewing [*R.A.E.*, A, xvii, 310, 454] was found in 1932 infesting stocks of bulbs of nine varieties of *Narcissus* in several localities in England, where its distribution appears to be fairly general. In one case the bulbs had been in the country for a number of years, which makes it improbable that the mite is of recent importation. A study of its bionomics has been begun, and it is already apparent that it is responsible for the so-called loss of vigour in many field stocks, and is further capable of causing complete or partial failure of the flower-crop, particularly in forced bulbs.

MASSEE (A. M.). **A new Species of Gall-mite from South India.**—*Ann. Mag. Nat. Hist.*, (10) xi, no. 62, pp. 201–203, 1 pl. London, February 1933.

Eriophyes cheriani, sp. n., which causes galls on the leaves of *Pongamia glabra*, is described from Madras. The galls sometimes attain a length of nearly half an inch, and a large number occur on a single leaf. Infestation is often so severe that the majority of the leaves on the tree are affected.

THOMAS (A.). **Der Getreidelaufkäfer** (*Zabrus tenebrioides* **Göze), ein bisher zu wenig beachteter Getreideschädling.** [*Z. tenebrioides*, a Pest of Cereals hitherto too little noticed.]—*Die kranke Pflanze*, ix, no. 11–12, pp. 113–115, 2 figs. Dresden, 1932.

Of recent years, *Zabrus tenebrioides*, Goeze, has become an increasingly serious pest of cereals in north-western Saxony. Instances of injury to rye are mentioned. No success has attended attempts to combat the larvae with an arsenical dust or other insecticides.

LOKSCHA (H.). **Verhütung von Halmfliegenbefall** (*Chlorops taeniopus*). [The Prevention of Attack by the Stem-fly, *C. taeniopus*.]—*Ernähr. Pfl.*, xxviii, no. 20, pp. 357–358. Berlin, 15th October 1932.

Chlorops taeniopus, Mg., is a constant and very serious pest of wheat in Moravia. Its occurrence on rye and oats is sporadic, and infestation of barley is negligible. One reason for its recurrent attack is that up to 1929 a close-eared, late-ripening wheat was grown. In this region infestation can only be avoided by growing a loose-eared wheat, and sowing it early in autumn or spring. The preceding crop is also important. Wheat sown after a cereal is always more severely attacked than after another crop with the exception of clover. Wheat following clover is as a rule severely attacked, especially if the clover field is ploughed late, so that the soil is loose and contains undecomposed roots. The physical character of the soil is therefore a factor, all circumstances hindering or interrupting growth being favourable to infestation. Nitrogenous manures encourage attack by softening the stem-tissue and by prolonging the period of growth, whereas an increase of potash and phosphoric acid is of value in preventing infestation, besides improving the quality of the crop.

SPEYER (W.). **Kann sich die Obstmade** (*Cydia pomonella* **L.) ausschliesslich von Blättern ernähren ? Zugleich einige andere Beiträge zur Biologie des Apfelwicklers.** [Can the Larva of *C. pomonella* feed exclusively on Leaves ? With some other Contributions to the Biology of the Apple Tortrix.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 2, pp. 183–191, 1 fig., 1 pl., 11 refs. Berlin, August 1932. [Recd. January 1933.]

Experiments are described in which larvae of *Cydia pomonella*, L., matured successfully when fed on apple leaves only, though the duration of the fourth and fifth instars was prolonged and the resultant pupae and adults were remarkably small. In the laboratory the adults lived for about a month at an average temperature of 18·5°C. [65·3°F.]. The egg stage lasted 10 days at 19°C. [66·2°F.] and 13–14 days at 17°C. [62·6°F.]. The appendages of the head of the larva and the

methods of feeding on the leaves and fruits are described. The author has occasionally found larvae of *Eurrhypara urticata*, L., in trap-bands on apple in Germany, though he does not know what plant they came from; as they may be mistaken for those of *C. pomonella*, the morphological differences are described and figured.

KNOCHE (E.). **Klima und Nonne. I. Die Entwicklungsruhe des Embryo.** [Climate and the Nun Moth. I. The Diapause of the Embryo.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 2, pp. 193–235, 12 refs. Berlin, August 1932. [Recd. January 1933.]

This is the first part of a paper on the relation of climate to the nun moth [*Lymantria monacha*, L.], which has one generation a year and overwinters in the egg-stage. The eggs mature during the summer in which they are laid, but the larvae do not hatch until the following spring. In Germany abnormally hot summers are a preliminary to serious outbreaks and wet, cold ones lead to their decline. A detailed account is given of investigations on the effect during the diapause of warmth and atmospheric humidity at room-temperature and at 25 and 33°C. [77 and 91·4°F.], and on the effect of loss of water on incubation and on the eggs. It is concluded that the diapause is due to a marked retardation of oxidation processes independent of external warmth. To counteract the accelerative power of warmth there must therefore be interposed in the egg a corresponding retardation of oxidation. This physiological retardation of oxidation gradually abates during the diapause.

KRÜGER (K.). **Vergiftungserscheinungen an Weidevieh nach der Verwendung von arsenhaltigen Stäubemitteln.** [Poisoning in pastured Cattle after the Application of arsenical Insecticides.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 1, pp. 1–2. Berlin, January 1933.

Cases of poisoning of pastured cattle by arsenical insecticides have occurred in Germany. In an instance here recorded 3 cows were killed in mid-September by feeding on bird's foot trefoil (*Lotus corniculatus*) that had been dusted on 18th June with an arsenical preparation against *Hypera* (*Phytonomus*) *variabilis*, Hbst. The seed crop had been harvested in August.

FRAENKEL (G.). **Die Wanderungen der Insekten.** [Insect Migration.] *Ergebn. Biol.*, ix, pp. 1–238, 36 figs., 26 pp. refs. Berlin, 1932. [Recd. January 1933.]

In this survey of data on the whole subject of insect migration, individual chapters are devoted to the various orders of insects concerned and to methods of observation and investigation, character of the swarms, instincts, climatic factors, and direction of migration.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. deuts. PflSchDienst*, Beilage, iv, no. 5, pp. 154–218. Berlin, 1st January 1933.

This part includes German regulations against the importation of living individuals of any stage of *Leptinotarsa decemlineata*, Say; against the importation of azaleas (*Azalea indica*) suspected of being

infested by *Gracilaria azaleella*, Brants, or *Peronea* (*Acalla*) *schalleriana*, L.; and against the importation between 15th March and 30th November of cut carnation flowers as a precaution against the introduction of the carnation Tortricid [*Tortrix pronubana*, Hb.].

VILLENEUVE (J.). **Notes diptérologiques.**—*Bull. soc. ent. Fr.*, xxxvii, no. 18, pp. 271–272. Paris, 1932.

Three specimens of a fly received in August 1931 from Michigan, and believed in America to represent the Palaearctic Tachinid commonly known as *Ceromasia senilis*, Mg., or *Lydella grisescens*, R.-D., which the author considers to be a subspecies of *L. stabulans*, Mg. [*R.A.E.*, A, xix, 71], proved on examination to correspond exactly with the specimens taken near Paris. The author considers that all these individuals constitute an intermediate form between *L. stabulans* and *L. stabulans grisescens*, to which he gives the name *L. stabulans* var. *intermedia*, n. According to H. L. Parker, the American specimens were reared from *Papaipema nebris*, Gn., and the same form has been obtained from *Pyrausta ainsliei*, Heinr., *Achatodes zeae*, Harris, and *Papaipema cataphracta*, Grt. The Tachinid known in America as *Masicera myoidea*, R.-D., is almost certainly identical with it.

BOVEY (P.). **Le phytopte du poirier.**—*Rev. hort. suisse*, 1931, no. 12, reprint 4 pp., 4 figs. Geneva, December 1931. [Recd. December 1932.]

Eriophyes (*Phytoptus*) *pyri*, Pgst., which chiefly attacks pear trees, lives within the leaf tissues, causing the formation of small galls that project from both surfaces of the leaves. The adults hibernate in groups under the scales of the leaf buds, and when the buds open, they move into the young leaves not yet uncurled, penetrating the lower epidermis. The eggs are laid within the leaves, in which the young mites that hatch from them develop. When the tissues of the galls are consumed, they migrate to the youngest leaves and form fresh galls. There are two generations a year in Switzerland, and sometimes three if the weather is favourable. In September the adults of the last generation quit the leaves to take shelter under the bud-scales. When there are few galls on the leaves, the injury caused is not of great importance. In the case of a heavy attack the fruits may also be infested, becoming deformed and dropping prematurely. Certain varieties are particularly subject to attack, and young trees are more susceptible than taller ones. The mite also occurs on apple. It is difficult to control during the summer, but may be reached under the bud scales by sprays. Of a number of insecticides tested in 1930 and 1931, when applications were made on 25th March and the results checked on 28th April and 28th May, 8 per cent. carbolineum, 20 per cent. lime-sulphur, or 4 per cent. winter Volck oil gave complete control, the unsprayed trees being heavily infested. Applications may be made in autumn as soon as the leaves have fallen, but preferably in March just before the buds open. Success depends on the complete wetting of all the buds with the spray.

BOVEY (P.). **L'anthonome du fraisier et du framboisier** (*Anthonomus rubi* **Herbst.**).—*Rev. hort. suisse*, 1932, no. 6, reprint 7 pp., 9 figs., 2 refs. Geneva, June 1932. [Recd. December 1932.]

An account, mainly taken from the literature and confirmed from personal observation, is given of the bionomics of *Anthonomus rubi*,

Hbst., which attacks strawberry, raspberry and loganberry in Sweden, Switzerland and the neighbouring European countries [*R.A.E.*, A, xviii, 694 ; xix, 611, etc.]. All stages of the weevil are described. Although no variety of raspberry is immune, it has been observed in Sweden that early varieties are more susceptible than late ones. In laboratory observations in Switzerland *A. rubi* showed a marked preference for the flower buds of loganberry over those of raspberries, strawberries and blackberries. It is susceptible to control by insectitides only in the adult stage. The best results have been obtained with arsenical and pyrethrum dusts applied to raspberry canes at regular intervals during the oviposition period, but neither material has secured complete control. In Switzerland the injury caused is not sufficiently serious to necessitate general control measures, except where an attack follows partial destruction of the crop by frost.

CUSCIANNA (N.). **Comparse di Cavallette nella Venezia Giulia.** [Outbreaks of Grasshoppers in Venetia.]—*Nuovi Ann. Agric.*, xii, pp. 303–343, 10 figs., 11 refs. Rome, 1932.

From 1929 to 1932 annual outbreaks of grasshoppers occurred in certain areas in Venetia. The most important species was *Calliptamus italicus*, L., but associated with it were *Oedipoda coerulescens*, L., *Arcyptera microptera*, F. W. (*flavicosta*, Fisch.) and *Chorthippus* sp., as well as the long-horned grasshoppers, *Tettigonia* (*Phasgonura*) *viridissima* L., *Decticus albifrons*, F., *D. verrucivorus*, L., and *Platycleis* sp.

The hoppers of *Calliptamus italicus*, which hibernates in the egg stage, hatch from April till July and reach the adult stage in 30–40 days. The eggs are laid from June until August in uncultivated ground with sparse vegetation. The plants damaged included potatoes, tobacco, cotton, medicinal herbs, and probably grain crops. *Tettigonia viridissima* was repeatedly observed attacking the ears of wheat.

Control measures included spraying with 2 per cent. sodium arsenite on uncultivated land, poison baits, and collection by means of nets. This last method was chiefly used against the large Tettigoniids, and great numbers were collected each year and purchased at a fixed price by the authorities.

In Cherso Island there occurred in 1931 an extensive outbreak of long-horned grasshoppers of the genera *Barbitistes* and *Pholidoptera*, which defoliated wild shrubs, and caused damage in vineyards, orchards and maize fields. Owing to the insects being scattered over a large area, no control measures were possible, but the fungus, *Empusa grylli*, eventually put an end to the outbreak.

ŞEVKET (N.). **Garbî Anadolu Zararlilari. 4–5.** [Pests in West Anatolia. 4. *Phthorimaea heliopa*, Lw. 5. *Opatroides punctulatus*, Brul.].—13 pp. Ankara, 1932.

The Tineid, *Phthorimaea heliopa*, Lw., oviposits on the leaves of tobacco. The larvae hatch within a week and attack the leaves and then the stalks. Feeding inside the stalk occurs in older plants, causing them to wither. As the larvae only attack tobacco, the best measure consists in uprooting and burning the plants left after the harvest. The Tenebrionid, *Opatroides punctulatus*, Brullé, which feeds at night, occurred in all tobacco districts in 1932, and did so much harm to seedlings that re-planting was necessary. The use of a sweetened poison bran bait is advised.

[ISAEV (S. I.).] **Исаев (С. И.). Insects injurious to Onion in the Rostov District. II. The Onion Fly** (*Hylemyia antiqua* **Meig.). Part I.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 2, pp. 13–58, 12 figs., 5 graphs. Leningrad, 1932.

This paper is one of a series on onion pests in the Rostov district of the Yaroslav Government [*R.A.E.*, A, xx, 150]. *Hylemyia antiqua*, Mg., all stages of which are described, is widely distributed in the Russian Union, where it is a pest of primary importance, onions being one of the staple products for export. Much of the information given on its bionomics is taken from the literature. In the Rostov district there are two complete generations a year, which overlap, and a partial third if the autumn is warm and protracted. The flies from overwintering puparia occur from late May or early June until mid-July. Cool, rainy weather delays oviposition, and the flies sometimes die before having laid many of their eggs. In 1926 the adults of the first generation were on the wing from the end of July throughout August. The length of the preoviposition period depends on weather and conditions of nutrition of the adults; in the spring of 1927 it lasted 8 days. Eggs are laid in rows or clusters of 7 and more; investigations in the spring of 1927 showed that 59 per cent. are laid at the base of the inner side of the leaves, 29 per cent. between the scales of onions and in cracks in the soil near the stem, and only 12 per cent. on the upper parts of the leaves. As the severest infestation occurred on onions sown on 14th and 20th June, whereas only a few eggs were laid on those sown in May, the use of trap beds of late-sown onions is suggested for control. In the laboratory the eggs hatched in 3–8 days. In the Rostov district, onions, and occasionally garlic and leeks were the only plants attacked [*cf.* xi, 71]. Most of the larvae occurred inside the bulb, or in the neck just above the surface of the soil; those that hatch from eggs laid on the leaves mine downwards in them until they penetrate into the bulb. The larvae sometimes migrate in the soil to neighbouring plants. In the Rostov district they are present from June till the end of September, the larval stage lasting 14–22 days. Pupation occurs in the soil; 54 per cent. of the pupae were found at a depth of up to 2 ins., 39 per cent. at 2–4 ins., and 7 per cent. at 4–6 ins. They are nearest to the surface in heavy or damp soil, and soil conditions should be taken into consideration when ploughing or digging the onion beds in the autumn to expose the pupae.

[POTAPOV (A. N.).] **Потапов (А. Н.). The Aeroplane at Work when controlling the Asiatic Locust in the Daghestan Soviet Socialistic Republic in 1931.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 2, pp. 59–115, 5 figs., 1 map, 1 ref. Leningrad, 1932.

The reed-beds of the Daghestan Republic harbour permanent breeding areas of *Locusta migratoria*, L., which are a constant menace to the crops of neighbouring regions. The area infested with locust eggs during the last seven years has fluctuated from 93,900 acres in 1926 to less than half that area in 1931; in 1932, 66,700 acres were reported infested. Control measures in 1931 consisted entirely of dusting from aeroplanes, sodium and calcium arsenite being used as poisons. During 30 working days, five aeroplanes dusted nearly 4,700 acres. The dosage of poison averaged 2·6 lb. per acre. The results were considered

satisfactory, as only about 370 acres of infested ground were left untreated ; the autumn survey, however, showed that 66,700 acres were again infested with eggs laid by swarms which, it is presumed, arrived from other regions.

[Stark (V. N.).] **Старк (В. Н.). Materials concerning the Biology of** *Anthonomus pubescens* **Payk.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 2, pp. 117–128, 3 figs. Leningrad, 1932.

In May and June 1930 severe damage was caused to young spruces in the Leningrad Government by the larvae of *Anthonomus pubescens*, Payk., which destroyed the terminal buds on branches at a height of 2–6 ft. from the ground. The infestation occurred almost exclusively at the edges of the zones of spruce, but occasionally on trees at a distance of about 200 yards from the border. In the adjoining pine forest, *A. varians*, Payk., was present in numbers, developing in male inflorescences ; in four instances, however, larvae and pupae were found in the buds of spruce. The characters distinguishing the larvae, pupae and adults of the two species are indicated. The buds were also attacked by 16 other insects, a key to which is given, based on the type of injury caused, with tables showing the injurious stage and the type and density of the spruce growths in which the pests occurred.

For the control of *A. pubescens*, an arsenical spray, applied at the time of the supplementary feeding of the weevils, is suggested. Trapping the adults in shelter-bands of straw or jarring them on to sheets on the ground give comparatively unsatisfactory results.

[Zorina (L. M.).] **Зорина (Л. М.). On the Biology of** *Depressaria depressella* **Hb.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 2, pp. 143–147, 4 figs. Leningrad, 1932.

An account is given of observations carried out in 1930 in the Rostov district on the Tineid, *Depressaria depressella*, Hb., which caused considerable damage to cultivated fennel [*Foeniculum vulgare*], and also occurred in smaller numbers on other umbelliferous plants. There are probably two complete generations a year, with a partial third. In the laboratory hibernation occurred in the adult stage. The eggs, larvae and pupae are described. In 1930 the first adults were taken in buildings (where they had probably hibernated) in the second half of May, and in the field one month later together with larvae of the second and third instars on inflorescences of fennel. In the beginning of July larvae of all instars were present in numbers on overwintered fennel, the infestation occurring chiefly on plants at the edges of the bed, where 48 per cent. of the flowers were attacked as compared with 2–5 per cent. in the centre. Larvae collected in the field pupated in the laboratory early in July and the first moths emerged between 7th and 26th July. The oviposition period lasted 5–15 days, eggs being laid on the pedicels and unopened flower buds of fennel. The total number of eggs laid by a female varied from 57 to 328. Unfertilised eggs did not hatch. At 30–31°C. [86–87·8°F.] the eggs hatched in four days, and in the field in five. The young larva penetrates into the opening flower, on which it feeds. Its presence can be easily detected by the excreta ejected on the surface of the flower. After having destroyed one flower, the larva migrates to an adjoining one, weaving them together

until the whole inflorescence is enclosed in a silken web ; sometimes the larva passes to the neighbouring inflorescence, but usually one is sufficient for its development. The older larvae also feed on the young seeds and leaves. Pupation occurs in the inflorescence in a transparent cocoon. In July and August 1930, under very dry and hot conditions, the larval and pupal stages lasted 15–18 and 7 days respectively.

In 1930 about 40 per cent. of the larvae and pupae were destroyed by parasites, including *Orgilus claripennis*, Ivan., *Brachymeria* (*Chalcis*) *rugulosa*, Först., and *Nemorilla* (*Thyella*) *floralis*, Fall., which were abundant, and to a less extent by *Pimpla alternans*, Grav., and *Pristomerus orbitalis*, Hlmgr. Several other species were reared from them in 1927 and 1928, *viz.*, *Cremastus discoidalis*, Szép., *C. dalmatinus*, Strobl, *Anilastus carbonarius*, Ratz., *Pimpla ovalis*, Thoms., *Habrocytus obscurus*, Thoms., and *Pachyneuron* sp.

[Pyatnitzkiĭ (G. K.).] **Пятницкий (Г. К.). A new Palaearctic Cedar Bark-beetle from Eastern Siberia,** *Orthotomicus golovjankoi* **Pjatn.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 2, pp. 173–179, 3 figs., 1 ref. Leningrad, 1932.

A further description [*cf. R.A.E.*, A, xix, 240] is given of *Ips* (*Orthotomicus*) *golovjankoi*, Pjatn. The beetles only occurred on *Pinus koraiensis*, being very abundant under the thick bark of fresh stumps, cut trees and logs in the forest and timber yards in the districts of Vladivostok and Lake Khanka. Since this Scolytid has never been found in the region of Lake Baikal or further westwards, the author believes that its distribution is limited to the Russian Far East.

[Knyazhetzkiĭ (B. V.).] **Княжецкий (Б. В.). On the Melolonthine Grubs injurious to the Restoration of Pine in Conditions prevailing in the North-west District.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 109–148, 4 figs., 7 graphs. Leningrad, 1932.

This is a detailed account of investigations in the Novgorod Government in 1927 and 1928 on the causes of the unsatisfactory development of self-sown young pines growing in dry sandy soil infested with larvae of *Melolontha hippocastani*, F., and *Amphimallus solstitialis*, L. The average number of lateral roots in pines varying in age from 4 to 18 years and taken from places differing in character and type of vegetation is discussed at length, and tables and graphs are given showing the number of larvae found to a square metre and the percentage of roots damaged. Comparing the results obtained, the author concludes that larger pines with a better developed root system are more severely attacked by the larvae than weaker trees, and that the damage caused by one-year-old larvae of *M. hippocastani* is only noticeable in the absence of more mature individuals. The relation of the loss in the current yearly increase in the height of the trees to the percentage of the roots destroyed by the larvae and to the number of the latter to a square metre of soil is discussed. The investigations indicated that the presence of 1 two-year-old larva per square metre in soils of the second and third quality class, or of 1 per 2 square metres in dry soils of the third class, is dangerous to the restoration of pine forests.

For protecting young plantations in waste land with a well-developed undergrowth, denser sowing or planting is recommended, so that the pines form a canopy in 8–10 years. Before planting a forest, breeding foci of Lamellicorn larvae should be located and the larvae destroyed ; such foci usually occur on the southern slopes of hills and the southern outskirts of forests.

[Bogdanov-Kat'kov (N. N.).] **Богданов-Катьков (Н. Н.). Révision des Hyménoptères nuisibles aux plantes potagères.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 149–195, 22 figs., 6 pp. refs. Leningrad, 1932.

This paper deals with the sawflies attacking vegetables and root crops in the Russian Union, the information given being to a large extent based on the literature. The distribution and bionomics of *Athalia colibri*, Chr., and *Ametastegia glabrata*, Fall., are discussed in detail and all stages described, and brief notes are given on *A. equiseti*, Fall., and *Emphytus* (*Emphytinus*) *tener*, Fall., with records of a few other species that are not considered of economic importance. In the Russian Union *Athalia colibri* has usually two generations a year, the adults being on the wing in May and August. A third generation may occur in the south. Eggs are laid singly into the cuticle along the vein on the lower surface of the leaves of wild and cultivated crucifers and hatch in 5–11 days. The larvae feed on the leaves and sometimes the flowers for 18–20 days ; instances of migration from weeds to cultivated crucifers have been observed. Pupation takes place in the soil in thick silk cocoons covered with particles of earth. The emergence of the adults, which occurs after 11–16 days, is accelerated by rainy weather followed by heat, and retarded by drought. Hibernation probably occurs as a mature larva in the cocoon. The yield of root crops is greatly affected by the loss of the assimilative leaf surface. The economic importance of the sawfly in various parts of the Russian Union is discussed, and its parasites and control are reviewed from the literature. Autumn ploughing to expose the hibernating cocoons, and a systematic destruction of weed food-plants in spring and early summer are recommended. In experiments in the Leningrad Government sprays of 3–4 per mille Paris green or 2 per cent. sodium fluoride greatly decreased the numbers of larvae.

Near Leningrad *Ametastegia glabrata* has four overlapping generations a year, hibernating in the larval stage in the stems of the food-plants and also probably in the soil. Pupation occurs in both these situations. Parthenogenetic reproduction may occur, the offspring being males. Oviposition begins 15–20 hours after emergence, eggs being laid singly in the leaves of various sorrels (*Rumex*), buckwheat, rhubarb and other polygonaceous plants, which the larvae skeletonise. Details of the biology and parasites are given from the literature ; no damage to apples has been observed in Russia.

A. equiseti, which attacks gooseberry and sorrel (*Rumex acetosella*), has caused considerable damage to the latter in the Leningrad Government, where it has four generations a year, usually pupating in the soil. Nicotine dusts and sprays may be used against the larvae on edible sorrel, or stomach poisons against those on plants cultivated for seed.

The biology of *E. tener* has been studied in the Ukraine, where it has four generations a year and feeds on sorrel, rhubarb, certain weeds and probably oak and beech. The oviposition period lasts 3–5 days, during

which a female lays over 100 eggs in the leaves. The larvae hatch in 3–6 days and reach maturity in 12–17, the diapause lasting 6–9. Pupation occurs in the soil. Parthenogenetic reproduction sometimes occurs, only males being produced.

Keys to the sawflies discussed are appended, together with a list of 14 species of Hymenoptera injurious to vegetables in the Palaearctic region, indicating their food-plants and distribution and the nature of the damage caused.

[GERASIMOV (A. M.).] **Герасимов (А. М.). Lepidoptera-Miners. I. Middle-Asiatic Species of** *Lithocolletis*. (**With Introduction on the Biology of Miners in general.**) [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 197–248, 35 figs., 21 refs. Leningrad, 1932. (With a Summary in German.)

As very little is known in the Russian Union about leaf-mining Lepidoptera, general information is given from the literature on the changes caused in the tissues of the leaves by the mining of the larvae and their effect on the plant, together with brief notes on the food-plants and distribution of 18 species of economic importance, of which those observed in the Russian Union [*cf.* also *R.A.E.*, A, xix, 500], include *Coleophora hemerobiola*, Filip'ev, on fruit trees *Leucoptera* (*Cemiostoma*) *scitella*, Zell., on apple, and *Lithocolletis malella*, Grsm., on apple and quince, all in Central Asia ; *Lyonetia clerkella*, L., on cherry and *Tischeria complanella*, Hb., and *Gracilaria* (*Coriscium*) *brongniardellum*, F., on oak, in central Russia ; and *Anacampsis anthyllidella*, Hb., on lucerne in Central Asia and southern Russia.

The biology of leaf-mining Lepidoptera and the different types of mines are also discussed. Keys are given to the more important species, based on the character of the injury caused, to the genera of the family GRACILARIIDAE, and to the Central Asiatic species of *Lithocolletis*, with descriptions from the literature of the adults and male genitalia of several of the latter.

[KAZYAKINA-VINOGRADOVA (V. N.).] **Казякина-Виноградова (В. Н.). On the Biology of the Pocket-moth** (*Ornix guttea* **Hw.**). [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 249–252, 8 figs. Leningrad, 1932.

The Tineid, *Parornix* (*Ornix*) *guttea*, Haw., caused considerable damage to apple foliage in a district in the Leningrad Government in 1930, when it infested about 50 per cent. of the leaves, and was numerous in 1931 in the Lower Volga Region and western Russia. The larva first mines in the upper surface of the leaf, and subsequently skeletonises the lower surface at the edge, which it rolls downwards to form a " pocket " fixed to the leaf surface by a thick web. Pupation usually occurs in a cocoon under the bark or in cracks ; hibernation takes place in the pupal stage.

Brief descriptions are given of the larvae, pupae and adults, including the genitalia of both sexes. Measures suggested for control include the removal of dry foliage and twigs and old bark in autumn, the use of trap bands of sacking, which should be applied when the older larvae are numerous and removed after the first frosts in autumn and before the buds open in spring, and spraying infested trees with nicotine.

[KRYUKOVA (F. A.).] **Крюкова (Ф. А.). Collembola injurious to Vegetables and their Control.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 253–277, 20 figs., 143 refs. Leningrad, 1932.

In view of the almost complete lack of data on Collembola in Russia, a general account, based on the literature, is given of their economic importance, biology and morphology, with a key to the families and lists of species that have been recorded as pests of vegetables. Notes are also given on the bionomics of each species separately, and in some cases their morphology, distribution, importance and control are discussed. Of the 11 species recorded from the Russian Union, *Bourletiella hortensis*, Fitch (*pruinosa*, Tullb.), all stages of which are described, is the most important. In the Leningrad Government it appears early in the spring on a variety of sprouting vegetables. In the field the eggs are probably laid on decomposing leaves and other damp material on the soil ; in the laboratory they were deposited on moist filter paper in batches of 2–13 and hatched in 18–20 days at 20°C [68°F.]. Feeding began on the second day after hatching, only sprouting plants with not more than two leaves being attacked. Observations showed that the Collembola were attracted by the sap exuding from the plants, and readily ate into parts that had already been injured by flea-beetles. Laboratory observations, which were confirmed in the field, showed that peas, beans, beet, radish, swedes, turnips and cucumbers were attacked with equal readiness, whereas cabbage was less attractive.

The importance of this springtail is discussed. In the summer of 1931 about 80 per cent. of sprouting swedes were injured by it, as many as 40 individuals occurring on a plant in some instances. In experiments with insecticides, the percentages of mortality obtained were 78 with a nicotine dust, 50 with a mixture of Paris green with ashes or tobacco dust, 45 with tobacco dust alone, and 33 with a spray of soft soap.

[GERASIMOV (A. M.) & GERASIMOVA (F. N.).] **Герасимов (А. М.) и Герасимова (Ф. Н.). Notes on the Pests injurious to *Apocynum sibiricum* Pall. in the District of Khorezm.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 279–281. Leningrad, 1932.

The insects found attacking wild and cultivated *Apocynum sibiricum* in central Khiva in July and August 1929 were : *Mylabris triangulifera*, Heyd., on the flowers ; the Eumolpid, *Chrysochus* (*Chrysochares*) *punctatus*, Gebl., the Galerucid, *Monolepta angustula*, Wse., and a Noctuid larva on the leaves, a number of which were also mined by *Nepticula* sp. ; the Lygaeid, *Spilostethus equestris murinus*, Kirich., on the immature fruits ; and *Lepidosaphes ulmi*, L., on the stems.

[PYATNITZKIĬ (G. K.).] **Пятницкий (Г. К.). Contribution to the Fauna of Barkbeetles of the Woods of Maicop District.** [*In Russian.*] *Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 295–302, 1 ref. Leningrad, 1932.

A list is given of 42 species of bark-beetles observed in the summers of 1927–30 in mixed forests in the Maĭkop district of the North Caucasus, with brief notes on their local distribution, the dates on which they were found, and the trees and parts attacked. The most prevalent

species were *Cryphalus orientalis*, Egg., on standing *Abies* and the following on felled trees: *Scolytus scolytus*, F., and *S. pygmaeus*, F., on elms, *Xyleborus xylographus*, Say (*saxeseni*, Ratz.) on alder, oak, maple and *Abies*, *Cryphalus* (*Ernoporus*) *caucasicus*, Lind., on young limes [*Tilia*], *Taphrorychus villifrons*, Dufour, on oaks, beeches and *Carpinus*; and *Ips* (*Pityokteines*) *curvidens*, Germ., on *Abies*. *I.* (*P.*) *vorontzowi*, Jakobs., which has not previously been recorded further east than Poland, usually occurring on *A. pectinata*, was sometimes found in association with *I. curvidens* on *A. nordmanniana*.

[TARBINSKIĬ (S. P.).] **Тарбинский (С. П.). On the Question of the Phase Variability of Locusts.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 303–320, 3 figs., 1 graph, 41 refs. Leningrad, 1932.

The existence of a solitary phase in *Dociostaurus maroccanus*, Thnb., was proved by a study of isolated individuals in the field in Transcaucasia, and by cage experiments. The solitary phase differed from the gregarious one in the coloration of both the larval and the adult stages, and in the relative length of the elytra and hind femora; the differences are actually parallel to those observed between the respective phases in other species of locusts. In the author's opinion there is no reason to doubt the occurrence of phase transformation in locusts, but this transformation merely represents a result of fluctuations in population density, which are due to environmental factors. The periodicity of locust outbreaks, therefore, does not depend on phase transformation.

[LUGOVOĬ (A.).] **Луговой (А.). On the Silvicultural Methods of controlling the Cockchafer. Based on Investigations in different Types of Plantations in the Forest of Tzarevshchino of the Central Volga Region.** [*In Russian.*]—*Trud. Issledov. lesn. agrolesomeliorat. opuitn. Delu* [*Trans. Res. For. & agro-silvi-improv. exptl. Work*], no. 1, pp. 85–108, 3 figs., 2 maps, 10 refs. Moscow, OGIZ, 1932.

Investigations, carried out in 1928–30 in the Samara Government, in a pine forest with deciduous undergrowth revealed a widespread infestation by *Melolontha hippocastani*, F., the intensity of which varied considerably in different parts of the forest according to the amount of shade. The topography of the locality and the types of the soil and vegetation in the forest, which formed three distinct zones, are described. Most of the larvae occurred in sandy soil, preference being shown for localities exposed to a moderate degree of sunlight, such as narrow strip clearings; infestation was considerably less in wide clear felled areas exposed to the sun, with only a scanty grass vegetation and lacking in humidity. In the zone where the soil consisted of mixed sand and clay, however, more larvae occurred in wide strip clearings than in narrow ones. Compact clay soil was practically free from infestation. In all zones the rate of infestation was low where the trees and undergrowth formed a canopy; this was probably due to lack of insolation and warmth, as there was a sufficient amount of moisture.

These observations indicate the possibility of control by silvicultural methods. Clear felling over large areas or in wide strips should be adopted on sandy soil, and in narrow strips on clay-sand. Since dense shade is unfavourable to the larvae, aspens should be planted among the pines. Hand collection of the adult beetles should be

organised, and on sandy soil field crops should be cultivated for a number of years prior to the planting of the trees ; this, however, should not be done in clay soil.

Other Lamellicorns that occurred in the forest, in order of their importance, were *Amphimallus solstitialis*, L., *Serica brunnea*, L., *Polyphylla fullo*, L., *Anomala aenea*, DeG., and *Phyllopertha horticola*, L.

FORSIUS (R.). **Ueber einige aus *Diprion polytomum* Htg. gezüchtete Schlupfwespen.** [On some Hymenopterous Parasites bred from *D. polytomum*.]—*Notul. ent.*, xii, no. 4, pp. 86–87. Helsingfors, 31st December 1932.

Exenterus tricolor, Roman, *Lamachus spectabilis*, Hlmgr., and *Holocremnus ratzeburgi*, Tschek., are recorded for the first time in Finland, where they were bred from cocoons of *Diprion polytomum*, Htg.

LATASTE (F.). **Nouvelles observations sur le criocère du lis.**—*Rev. zool. agric.*, xxxi, no. 10, pp. 161–163. Bordeaux, October 1932. [Recd. January 1933.]

Further studies of the lily beetle [*Lilioceris* (*Crioceris*) *lilii*, Scop.] [*R.A.E.*, A, xix, 567] in France indicate that adults of the generation developing from eggs that hatch after the lily has flowered, at the end of June and beginning of July, are incapable of immediate reproduction. Oviposition does not take place until after hibernation, in March of the following year. The beetles are, however, capable of surviving at least two winters and oviposit in two successive years. The female of one pair under observation laid 367 eggs between 21st March and 24th August 1931, and 160 between 18th March and 12th April 1932, when it died. Data are given concerning mating and oviposition, and the egg is described.

Catches of adults indicated that the maximum is reached in the second generation, from the middle of May till the middle of June, and that the numbers present decrease to about one-half from one year to the next. The decrease was even more marked in the case of the eggs and larvae, and by the third year the infestation under observation had practically died out. This result was obtained by collecting and destroying the adults, leaving the larvae to be killed by their parasites.

TOPI (M.). **La Lotta antiacridica nel 1932 ed i suoi insegnamenti.** [The Anti-locust Campaign in 1932 and its Lessons.]—*Ital. agric.*, lxix, no. 12, reprint 10 pp., 3 figs. Rome, December 1932.

In 1932, an outbreak of *Dociostaurus maroccanus*, Thnb., occurred throughout the whole of Sardinia and parts of the province of Rome. Control measures consisted mainly of the use of sodium arsenite sprays as both internal and contact insecticides. Poisoned baits also proved to be most effective. Owing to the danger to domestic animals, however, the use of sprays of cresosol is recommended for future campaigns. This is a miscible tar oil containing 16–18 per cent. phenols and cresols with 20–25 per cent. soap and is more expensive than sodium arsenite. Powerful motor-sprayers were used with great success. The need for a special anti-locust organisation is emphasised.

HODSON (W. E. H.). **The Large Narcissus Fly,** *Merodon equestris*, **Fab. (Syrphidae).**—*Bull. Ent. Res.*, xxiii, pt. 4, pp. 429–448, 1 fig., 1 pl., 24 refs. London, December 1932.

A detailed account is given of comprehensive investigations carried out in England over eight seasons on the bionomics and control of *Merodon equestris*, F., with a view to elucidating certain fundamental points. Descriptions are given of the various stages, and the colour varieties of the flies are discussed. The history of the distribution of this Syrphid is dealt with, and the food-plants are enumerated. No parasites were obtained during the investigation. Numerous control measures are reviewed, and the most satisfactory combination recommended for use in the field includes the application at weekly intervals of a poison bait-spray [*R.A.E.*, A, xix, 374] at the rate of 8–10 gals. per acre, or in the case of valuable bulbs at more frequent intervals at the rate of 16 gals. per acre.

GOLDING (F. D.). **Sodium Fluosilicate as a Poison against the Hoppers of** *Locusta migratoria migratorioides*, **R. & F., in Nigeria.**—*Bull. Ent. Res.*, xxiii, pt. 4, pp. 449–461, 16 refs. London, December 1932.

Owing to the potential danger from the use of arsenicals against *Locusta migratoria migratorioides*, Rch. & Frm., in northern Nigeria to the native tribes who use locusts as food, as well as to domestic animals, tests have been made with sodium fluosilicate.

The following is taken from the author's summary: This poison was found as effective in baits as sodium arsenite when used in the same concentration, *viz.*, 2·44 per cent., but was slower in action. When guinea-corn [*Sorghum*] bran was used as the carrier, it was necessary to add salt as an attractant, although this was not the case when sawdust, chopped hay or chaff were employed.

From an examination of the results of experimental work on the relative toxicities of sodium fluosilicate and arsenical compounds to domestic animals in various parts of the world, it is concluded that the former is less toxic to stock, but that the increased degree of safety acquired through its use is not so great as is popularly supposed. A definite advantage of baits containing fluosilicate is that they are repellent to many animals, whereas those containing sodium arsenite are attractive to stock. Although sodium fluosilicate is cheaper than sodium arsenite, the need for adding salt to baits containing it would largely vitiate this advantage in Nigeria where the cost of transport to the interior is very high. Experiments showed that chopped hay was a satisfactory carrier with either fluosilicate or arsenite; and a test of paper (newspaper torn up to pieces of about 2 square inches) as a carrier gave promising results.

DAVIES (W. M.). **Ecological Studies on Aphides infesting the Potato Crop.**—*Bull. Ent. Res.*, xxiii, pt. 4, pp. 535–548, 1 fig., 8 refs. London, December 1932.

An account is given of investigations on Aphids attacking potatoes at a centre in north Wales during 1931.

The following is taken from the author's summary: The majority of Aphids observed during the initial period of infestation in early June

were solitary apterous viviparous females, and their presence is explained by possible overwintering on weeds and field plants, by the deposition of single nymphs by the first alate females, which then migrated, or by the planting of infested seed. The maximum infestation occurred during mid-July, when 86 per cent. of the leaves were infested with an average of 2·8 Aphids to a leaf. The infestation, estimated at about 2,000,000 individuals to an acre, was less than for the previous three years. *Macrosiphum gei*, Koch, was the commonest species ; it bred at first on the flower-heads, and its numbers rose and fell rapidly. *Myzus persicae*, Sulz., was less abundant, and its numbers increased and decreased more slowly, the maximum being maintained for a longer period. *M. solani*, Kalt. (*pseudosolani*, Theo.) was taken in small numbers in August.

A technique was established to ascertain the movements of Aphids within the crop. Weekly records revealed that 100 per cent. of the Aphids changed their position and that at least 84 per cent. of each species migrated from leaf to leaf within the week. Daily records during the period of maximum infestation showed that 84 per cent. of *Macrosiphum gei* and 73 per cent. of *Myzus persicae* moved within 24 hours and of these at least 50 per cent. left the leaves on which they had been observed. *M. persicae* becomes established during the autumn and winter on field plants, such as swedes, cabbages, chickweed (*Stellaria media*) and goosefoot (*Chenopodium album*).

MURPHY (P. A.) & MCKAY (R.). **A Comparison of some European and American Virus Diseases of the Potato.**—*Sci. Proc. R. Dublin Soc.*, N.S., xx, no. 27, pp. 347–358, 37 refs. Dublin, September 1932.

The following is taken from the authors' summary : Leaf-roll, aucuba mosaic and intraveinal mosaic are shown to be identical in Europe and America. The wilding condition observed in Europe is shown to be due to a virus disease identical with the American witch's broom. European simple mosaic has not been described on potatoes in America, but is of common occurrence on American potatoes and is probably equivalent to the healthy-potato virus. American mild mosaic is not equivalent to European simple mosaic, but approaches more nearly to European crinkle, with which rugose mosaic is not identical. A streak disease similar to that known in Europe as " up-to-date " was common in the American healthy and diseased plants. American streak was found to be different from this disease. Leaf-rolling mosaic may have affinities with para-crinkle. The identity of the remaining American diseases was not established.

STARÝ (B.). **Ueber minierende Insekten Mährens und Schlesiens.** [On mining Insects of Moravia and Silesia.]—*Acta Soc. Sci. nat. moravicae*, vi, no. 52, pp. 125–242, 7 figs., 44 refs. Brunn, 1930. (In Czech with a Summary in German.)

This is a catalogue of the leaf-mining Diptera, Lepidoptera, Coleoptera and Hymenoptera of Moravia and Silesia, with a list of the food-plants concerned. The number of species involved is 381, of which 131 are new to this region. Four species are new to science.

PUSTET (A.). **Ein Versuch zur Begasung von Speicherschädlingen in Getreidesilos mit Wechsellüftung.** [An Experiment in the Fumigation of Warehouse Pests in Grain Silos ventilated by an Air-current alternating in Direction.]—*Nachr. SchädlBekämpf.*, A, vii, no. 4, pp. 136–145, 3 figs. Leverkusen, December 1932.

Increasing numbers of grain silos are being fitted with a ventilation system for the removal of oxygen, cooling and drying. This has suggested the possibility of destroying grain pests by adding a gas insecticide to the air circulating in all parts of the stored mass. In an experiment in Germany here described, a tank containing Areginal, a proprietary fumigant in liquid form [*R.A.E.*, A, xx, 342], was fixed over the chamber whence the air, driven by a fan below, passes into one of the four vertical perforated pipes running up the corners of the silo and from it into the stored grain. The air is admitted alternately through one of two diagonally opposite pipes, so that three pipes are always available to carry it off. The liquid insecticide passes down by gravity from the tank into the air chamber, in which it is vaporised, this process being accelerated by an electric heater on the floor of the chamber. In this case the heater proved inadequate for rapid vaporisation, temperatures of 18–22°C. [64·4–71·6°F.] only being attained. Grain infested with *Calandra granaria*, L., *C. oryzae*, L., and *Tribolium navale*, F., was placed in gauze bags hung at intervals throughout the silo, which was then filled with barley. On 23rd May the tank was filled with 35 kg. Areginal (for 100 cu. m. space), and in about 8 hours the requisite concentration was reached in the silo. The gauze bags were removed on 27th May and examined at intervals for several months. Mortality of the two species of *Calandra* was almost complete, and 99 per cent. of *T. navale* were dead by 3rd June, and all by 23rd.

HERFS (A.). **Ueber den Teppichkäfer und seine Bekämpfung.** [On the Carpet Beetle and its Control.]—*Nachr. SchädlBekämpf.*, A, vii, no. 4, pp. 146–151, 6 figs. Leverkusen, December 1932.

During the past three years reports have been received from various parts of Germany of injury to woollen textiles by the larvae of the Dermestids, *Anthrenus verbasci*, L., and *A. scrophulariae*, L. A brief account of their bionomics is given. Control measures suggested include fumigation and the prevention of infestation by treating the material with a suitable moth-proofing agent.

GIORDANI SOIKA (A.). **Nota su** *Scleroderma domesticum* **Kieff. (Hym. Bethylidae).**—*Boll. Soc. venez. Stor. nat.*, i, no. 1, pp. 14–18. Venice, 15th November 1932.

In experiments in 1932 females of the Bethylid, *Sclerodermus domesticus*, Kieff., from mines of an Anobiid in a table at Venice oviposited in larvae of the Sphegids, *Trypoxylon figulus*, L., *Sceliphron spirifex*, L., and *Psenulus fuscipennis*, Dahlb., *Eumenes arbustorum*, Panz., and the Chalcid, *Leucospis gigas*, F. The larvae hatched in two days, on 29th August, and reached maturity on 9th September, the males pupating 4–7 days later and the females 6–9. The male adults emerged on 1st October and the female adults on 2nd–5th October. On emerging the males pierce the pupal cases of the females and pair inside them. About 37 per cent. of the adults were males, and

their extreme rarity in nature is probably due to death after pairing in the mines of the host. Parthenogenesis did not occur. Females lived without food for over a month. The immature stages and colour variations of the females are described.

Dustan (A. G.). **Vegetable Insects and their Control.**—*Bull. Dept. Agric. Canada*, N.S., no. 161 (Ent. Bull. no. 32), 74 pp., 65 figs. Ottawa, November 1932.

This bulletin chiefly consists of notes on the bionomics and the latest measures of control of the major insect pests of market garden crops and maize in Canada ; in cases in which one method is not applicable throughout, the Dominion is divided into three sections according to climatic and other conditions, and the appropriate measures are given for each. The more commonly used insecticides are discussed, various formulae being given, and notes on the treatment of poisoning resulting from their use are appended.

List (G. M.). **Report of the Entomologist.**—*45th Ann. Rep. Colo. Agric. Expt. Sta. 1931–32*, pp. 42–47. Fort Collins, Colo., 1932.

Some of the information contained in this report of investigations on insect pests in Colorado has been noticed from other sources. The cadelle beetle [*Tenebroides mauritanicus*, L.] and the Cucujid, *Laemophloeus* (*Cryptolestes*) *ferrugineus*, Steph., have caused some damage by attacking different stages of the grain moth [*Sitotroga cerealella*, Ol.] used for breeding *Trichogramma minutum*, Riley [*cf.* *R.A.E.*, A, xx, 684]. Tests of baits for grasshoppers indicated that salt in the poison formula is not beneficial and may even be detrimental, though molasses adds to the effectiveness, cane molasses being rather more effective than beet, and that there are no substitutes for bran as a carrier for the poison. Dried beet pulp, however, showed sufficient promise to justify further tests. A study of a number of potato fields with a view to determining the relation between *Paratrioza cockerelli*, Sulc, and " Psyllid yellows " indicated that the condition was independent of irrigation and cultural methods. The most important wild food-plants of the Psyllid were found to be *Quincula lobata*, *Solanum rostratum* and *Physalis lanceolata*. A study was made of the life-cycle of the Noctuid, *Stretchia plusiaeformis*, Hy. Edw., a rather serious pest of gooseberries in the Arkansas Valley.

Worthley (H. N.). **Some Tests of Spray Materials against San José Scale at the Pennsylvania State College.**—*Pennsylvania St. Hort. Ass. News*, ix, no. 1, pp. 22–26. State Coll., Pa., March 1932. [Recd. January 1933.]

Notes are given on the bionomics of the San José scale [*Aspidiotus perniciosus*, Comst.] on apple in Pennsylvania. In experiments in 1931 dormant oils gave better control than winter strength lime-sulphur, whereas tar oil winter wash failed to kill a satisfactory percentage of scales. Following satisfactory control by delayed dormant applications, liquid lime-sulphur in the five foliage applications held the scale in check, whereas flotation sulphur and sprays containing copper sulphate failed to do so. In cases where dormant applications had proved unsuccessful, lime-sulphur failed to prevent scale increase.

The great difference observed in the amount of scale-marked fruit on adjacent trees receiving different spray materials indicates that infestations in neighbouring orchards do not constitute a menace to trees on which the scale has been controlled.

Hodgkiss (H. E.). **Old Ideas of Insect Control in a New Setting.**—*Pennsylvania St. Hort. Ass. News*, ix, no. 1, pp. 26–37. State College, Pa., March 1932. [Recd. January 1933.]

The results of orchard spraying against insect pests of apples obtained in 1931 by growers in Pennsylvania are discussed with particular reference to the rosy apple aphis [*Anuraphis roseus*, Baker] and the codling moth [*Cydia pomonella*, L.].

Ingerson (H. G.). **The Future of Spray Residue Removal in Pennsylvania.**—*Pennsylvania St. Hort. Ass. News*, ix, no. 1, pp. 37–49. State Coll., Pa., March 1932. [Recd. January 1933.]

Experiences of the past few seasons in the use of lead arsenate against the codling moth [*Cydia pomonella*, L.] in all the eastern fruit-growing sections of the United States are reviewed to show that increased spraying of apples in Pennsylvania may shortly be necessary and that this may involve spray residue removal. The importance of early season sprays is demonstrated, and the use of more effective adhesives in combination with lead arsenate in these early applications is recommended. The imminent necessity of applying one or more midsummer sprays, involving subsequent spray residue removal, in some areas in southern Pennsylvania is foreshadowed. The main factors affecting the amounts of spray residue are outlined, and it is shown that residue can be removed at harvest time even after the use of the most effective spray combinations.

Hely (P. C.). **Insect Pests of Rice Crops on the Murrumbidgee Irrigation Area.**—*Agric. Gaz. N.S.W.*, xliii, pt. 11, pp. 809–812. Sydney, November 1932.

The cultivation of rice on a commercial scale has only recently been established in Australia, and though certain native insects have begun to attack it, they have not yet caused very serious injury. The most important in the irrigation area of the Murrumbidgee river in south-eastern New South Wales is the Melyrid, *Laius femoralis*, Blkb. The damage is caused by the adult beetles in February and March. The rice seems to become attractive in the milk stage and remains so throughout the dough stage, but in 1932 it was also attacked in the flowering stage in some cases. The beetles feed on the grain or push the glumes apart by working their mandibles along the sutures and attack the developing ovaries within. Infested heads are characterised by whitened grains, many of which fall from the panicles, leaving only the skeleton of the head. The injury is usually progressive from the margin of the crop, and unless concentrated to such an extent as to make stripping unprofitable, is of little relative importance. The adult beetles normally feed on the flowering organs of sedges and aquatic graminaceous plants, overwintering in weeds and rubbish. Fertilisation takes place during March and April, the males dying shortly afterwards. Oviposition probably occurs in the spring, gravid females being taken in August.

Winged swarms of *Chortoicetes terminifera*, Wlk., have caused some injury to late-sown rice crops in early December where the water was applied somewhat late.

Phragmatiphila sp. (rice stem borer), though not at present of any actual importance, has been recorded for the past few years, showing considerable fluctuation. Most of the crops examined during the 1930–31 season were slightly infested. Although the larvae are generally associated with barnyard grasses, they preferred rice under insectary conditions. *Typha* sp. may also act as a food-plant. There appear to be two broods a year, the winter being passed in the larval stage. The larval period of the first brood lasts about 25 days. The attack seems to begin when the panicles of the early plants are being extruded from the sheath. The eggs are laid in groups of about 6 on the lamina, and the larva first feeds on the surface tissue of the inside of the leaf sheath and then enters the main stem, where it feeds until the main central inflorescence is destroyed. Pupation occurs in the leaf sheath cavity or in the space previously occupied by the inflorescence, the pupal stage lasting from 12 to 21 days. Normally only one but occasionally two larvae are found in a stem. Two species of Hymenopterous parasites exercise considerable control, 90 per cent. of the larvae in some crops being attacked. No direct control measures are at present required, but the destruction of weeds and old rice stubble would reduce the numbers of the moth.

Minor damage to rice was caused by a Trichopterous larva that bites through the stems of the newly germinated plants, and by *Ceratia* (*Aulacophora*) *olivieri*, Baly, and *Haltica ignea*, Blkb., which occasionally attack the grain in the panicles.

N.S.W. Dept. Agric. **Amended Regulations for Fruit Fly Control.**—*Agric. Gaz. N.S.W.*, xliii, pt. 11, pp. 861–862. Sydney, November 1932.

These amended regulations for the control of Trypetids in certain areas in New South Wales [*R.A.E.*, A, xx, 167] enforce the removal from the trees of all mandarin and Seville oranges of the main crop by 30th September. The amount of spray prescribed for weekly application to pome, stone, loquat, guava or persimmon trees is increased from 8 to 10 fl. oz. per tree. An alternative method of treatment for these trees provides for a fruit-fly trap to be attached to one tree in every 10 or less, for a period of at least 5 weeks immediately preceding the harvesting or ripening of the fruit, whichever is the earlier. Each trap must be kept baited with 6 fl. oz. of fruit syrup made by boiling 5 lb. of apples, pears or peaches in 1 gal. water, or of a mixture of $\frac{1}{8}$ fl. oz. synthetic vanilla, $\frac{1}{2}$ oz. household ammonia, and $6\frac{1}{2}$ pts. water. The trap is to consist of a glass bowl approximately 8 ins. in diameter and $4\frac{1}{2}$ ins. in height, having an opening at the base to permit the entry of the fruit-flies.

Glover (P. M.). **Department of Entomology.**—*Ann. Rep. Indian Lac Res. Inst. Namkum, Ranchi, 1931–32*, pp. 14–36, 2 pls., 1 ref. Calcutta, 1932.

Of the major pests of trees used for the cultivation of lac, *Aspidiotus* sp. on *Schleichera trijuga* and *Zizyphus jujuba* was satisfactorily controlled by pruning the trees and spraying with lime-sulphur. For the

control of this Coccid on grapefruit, lime-sulphur, which causes injury to the foliage and tender shoots, was replaced by a spray containing 1 lb. resin, 3 lb. crude castor oil, 180 lb. [18 gals.] water and $1\frac{1}{2}$ lb. ammonia [*cf. R.A.E.*, A, xvii, 504]. The Geometrid, *Semiothisa fidoniata*, Gn., occurred in numbers on *Acacia catechu* during November–December, large trees being completely defoliated and covered with webs. Good results were obtained with a contact spray prepared by boiling together tobacco and soft soap in water for half an hour. It appeared to be repellent to larvae and ovipositing females, and the majority of eggs on sprayed leaves in the field failed to hatch. Small outbreaks may be controlled by cultivating the soil round the trees to bring the pupae to the surface. A Tachinid was occasionally observed parasitising the larvae. The Noctuid, *Selepa* (*Plotheia*) *celtis*, Moore, which has several generations a year, often causes severe defoliation of *Ficus glomerata* and *Schleichera trijuga*. In September–November, the egg, larval and pupal periods lasted 6–10, 14–19 and 8–10 days respectively. Spraying with 1 oz. lead arsenate paste to 1 gal. water proved most effective. *Apanteles* sp. was reared in small numbers from the larvae. Damage by *Termes* sp. has been slight owing to the systematic fumigation of the termitaria and the encouragement of *Solenopsis geminata rufa*, Jerd. Large numbers of various Limacodids were observed defoliating several of the host trees of lac during October, pupation occurring in November. Hand-picking was found as effective as lead arsenate sprays where only small trees were concerned. One species of *Belippa* that occurred in fairly large numbers was controlled by a Braconid, possibly *Spinaria nigriceps*, Cam., which was itself attacked by *Brachymeria* sp.

Much of the information on the bionomics of *Laccifer lacca*, Kerr, its natural enemies and their control by biological and artificial methods has previously been noticed [xix, 650 ; xx, 10, 575, etc.]. A race has been maintained parthenogenetically since 1929 and has been carried through 6 generations. This method of reproduction does not appear to affect the sex ratio of the progeny or the fertility or development of the cells. As the resin secretion of the males is negligible, their elimination would probably be an advantage, allowing the colonisation of all available shoots by females and preventing the occurrence of a predominantly male brood as sometimes happens.

An Ichneumonid parasite of *Holcocera pulverea*, Meyr., previously recorded as *Pristomerus marginicollis*, Cam. [xix, 650] has since been identified as *P. testaceicollis*, Cam., by Ferrière, who considers that it may constitute a local race of the European species *P. vulnerator*, Panz. The Braconid, *Aphrastobracon flavipennis*, Ashm., a parasite of the Noctuid, *Eublemma scitula*, Ramb., is recorded as occasionally attacking *E. amabilis*, Moore.

Investigations on the Spike disease of Sandal. VI.—17 pp. Bangalore, Indian Inst. Sci., 1932.

An account is given by M. Appanna and C. Dover (pp. 12–14) of investigations on the relation of insects to spike disease of sandal [*Santalum album*], carried out by the Forest Research Institute at the Indian Institute of Science during the half-year period ending 30th September 1932. According to N. C. Chatterjee, healthy new flush was produced after pruning in June by plants that had contracted chlorosis

of the leaves as the result of the feeding of *Sympiezomias* [*cretaceus*, Faust], *Dereodus* [*sparsus*, Boh.] and *Myllocerus* sp. [*cf. R.A.E.*, A, xx, 539]. Periodic collections of insects from sandal in a situation where natural infection of these trees had not occurred for several years, despite the presence of numerous diseased plants, revealed the absence of *Acropona walkeri*, Kirk. (*prasina*, Wlk.), which is generally considered a probable vector.

Work at Dehra Dun is discussed by N. C. Chatterjee (pp. 15–16). As the result of qualitative insect collections made daily for 7 months beginning from October 1931 at selected situations in healthy and diseased areas in certain forests [*loc. cit.*], the specificity of various species with certain associations of host and sandal was established. Data obtained as to the relative abundance of the various families in percentages of the total Homoptera collected showed that the percentage incidence of Fulgorids, Psyllids, Aphids and Coccids was greater in diseased areas than in healthy ones. Analysis of the collections from the various host-sandal combinations showed that Aphids, which were present on sandal and the majority of associated plants, are abundant on *Scutia*. Psyllids are more abundant on *Zizyphus*-sandal than on *Canthium*-sandal, whereas thrips are relatively more abundant on the latter. *Moonia variabilis*, Dist., *Ledra mutica*, F., and *A. walkeri* were entirely absent from *Lantana*, the presence of which in the sandal forests is believed by some to be a factor contributing to the spread of the disease. Of the Curculionids, *Myllocerus* sp. is abundant on combinations of sandal and *Pterolobium*, *Lantana* or *Zizyphus*. Aphids collected on sandal have been identified as *Macrosiphum* sp.

DUPONT (P. R.). **Entomological and Mycological Notes.**—*Ann. Rep. Dept. Agric. Seychelles 1931*, pp. 10–11. Victoria, Seychelles, 1932.

In Seychelles coconut plantations that are exposed to the trade winds are seldom infested by Coccids, and this is attributed in many cases to the fairly high salinity of the atmosphere. Above certain altitudes, however, where the poor condition of the soil renders impractical the adoption of cultural control measures, their depredations necessitate the abandoning of coconut cultivation. *Ischnaspis longirostris*, Sign. (*filiformis*, Dougl.) and *Pinnaspis buxi*, Bch., were exceptionally abundant in 1931 ; the latter is attacked by Coccinellids to a greater extent than the former, which is increasing despite the presence of the fungus, *Pseudomicrocera henningsii*, which is now established [*cf. R.A.E.*, A, xix, 685]. This species together with *Sphaerostilbe coccidophthera* was discovered in April on bushes of *Hibiscus mutabilis* infested by *Aulacaspis pentagona*, Targ. *Pinnaspis minor*, Mask., was found on the leaves of young coconut palms in March ; *P. aspidistrae*, Sign., does not attack coconuts and shows a preference for *Dracaena* and *Heliconia* [*cf. loc. cit.*]. Damage caused by *Melitomma insulare*, Fairm., was reduced by earthing up or walling in the bases of the palms. It appears possible that the fungus, *Ganoderma lucidum*, renders the palms more susceptible to attack by *Melitomma*.

Phycita poteriella, Zell., was found in the stems and inflorescences of castor [*Ricinus communis*], but does not cause a great amount of damage and appears to be parasitised by an unidentified Ichneumonid.

LEEFMANS (S.). **Van een in vruchten borende uil** (*Ophideres fullonica* **Linn., de Indische Banduil).** [A Fruit-piercing Noctuid, *Othreis fullonica*.]—*Trop. Natuur*, xxi, no. 12, pp. 224–228, 3 figs. Weltevreden, 1932.

An account is given of observations on the Noctuid, *Othreis* (*Ophideres*) *fullonica*, L., the larvae of which were observed in Java on a climbing plant, *Tiliacora* sp. The eggs were also laid on the leaves of two other plants, which were not food-plants. The egg-stage lasted 3–4 days, the larval 13–17, and the pupal 12–18. *O. fullonica* and related species are " fruit-piercing moths," and the author observed experimentally the piercing of *Citrus* fruits by it.

CELINO (M. S.). **A fungous Disease of the Coconut Leaf Miner** (*Promecotheca cumingii*, **Baly).**—*Philipp. Agric.*, xxi, no. 7, pp. 481–490, 2 figs., 9 refs. Laguna, P.I., December 1932.

The fungus infesting adults of *Promecotheca cumingi*, Baly, on coconut in the Philippines [*R.A.E.*, A, xix, 11] has been identified as *Beauveria bassiana*. An account is given of laboratory investigations on its morphology, cultural characters and pathogenicity, the method of infection and the resulting symptoms of disease being described. Infection results from the contact of the spores with the body of the insect, and the presence of the whitish, chalky growth at the junction of the appendages and at the anal opening and mouth parts causes its death in 2–3 days. The application of a suspension of the spores in sterile water, either directly to the insects on the foliage or to the foliage before the introduction of the insects, resulted in a mortality of 43–58 per cent. in 6 days. Cool moist conditions are most favourable to the spread of the fungus, which has been observed on several occasions in the field.

CARTER (W.) & ITO (K.). **Some Effects of** *Pseudococcus brevipes* **(Ckl.) on Pineapple Fruit.**—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp. 37–39, Honolulu, November 1932.

A comparison of pineapples infested with *Pseudococcus brevipes*, Ckll., and those comparatively uninfested, in Oahu, Hawaii, where considerable injury to the fruit was reported in 1931 owing to the cracking of the basal eyes and resultant leaking of juice, clearly showed that the presence of mealybugs in large populations reduces the quality of the fruit by rendering the basal slices unmarketable as well as by increasing the number of fruits discarded owing to leaking and fermentation. The entrance of souring beetles was also much facilitated. The mealybugs tend to congregate on the more tender parts of the plant, and before the development of the inflorescence they infest the tender central leaves, moving up to the fruit as soon as it is formed and thence to the crown. They increase to large numbers, especially on the butt end of the fruit, where they are comparatively sheltered and protected from predators.

ITO (K.) & CARTER (W.). **Notes on Insects found on Pineapple planting Material.**—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp. 41–44. Honolulu, November 1932.

An investigation was carried out in December 1930 to collect quantitative data on the insect fauna present in pineapple planting material

while in process of curing on the trimming grounds in Hawaii, and to determine the effect of atmospheric heat on *Diaspis bromeliae*, Kern. (pineapple scale) infesting such material. Part of the material was placed, butt ends up, under a large enclosure covered with celoglass, where the temperature was thought to be sufficiently increased to destroy insects infesting it, and another part was left in the open, also with the butts of the plants turned upward, as in the ordinary practice of curing. Temperature records were kept of three different conditions at both places, but the final analysis of these showed no marked significance so far as the anticipated effects of temperature were concerned. Although the temperature rose to 99°F. on the butts of the plants under the celoglass, the insulation provided by the closely appressed plant material prevented the heat from penetrating to the lower parts of the plants where the insects were invariably found. Records are given of the different species of insects encountered during the dissection of the planting material samples.

It appears clear from the data accumulated that *D. bromeliae*, and to a less degree *Pseudococcus brevipes*, Ckll., can maintain themselves on dried planting material on the trimming ground. At the beginning of the experiment the populations consisted mainly of phytophagous insects, but the sample taken at the close showed the persistence of these species with considerable reduction in numbers and the introduction of a number of predacious species. It therefore appears that careful selection of planting material to be used as replants would constitute the best method of control, as the reproduction of any phytophagous insects that may be on the plant would be severely limited by the accumulation of predators.

TIMBERLAKE (P. H.). **Three new parasitic Hymenoptera from the Indo-Malayan Region.**—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp. 153–162. Honolulu, November 1932.

The species described are *Scelio serdangensis*, sp. n., and *S. pembertoni*, sp. n., both reared from the eggs of *Oxya velox*, F. (*chinensis*, Thnb.) in the Federated Malay States, and the Encyrtid, *Anagyrus saccharicola*, sp. n., from *Trionymus sacchari*, Ckll., in the Federated Malay States and the Philippines, and from an unidentified mealybug in Natal. A key is given showing the distinguishing characters of the two species of *Scelio* and of two other new species from Coimbatore, India, named in manuscript by Girault, *viz.*, *S. hieroglyphi* from eggs of *Hieroglyphus* and *S. oxyae* from eggs of *Oxya*. A second key shows the characters distinguishing *A. saccharicola* and three Old World species of the genus that closely resemble it.

RICHARDS (O. W.) & THOMSON (W. S.). **A Contribution to the Study of the Genera *Ephestia*, Gn. (including *Strymax*, Dyar), and *Plodia*, Gn. (Lepidoptera, Phycitidae), with Notes on Parasites of the Larvae.**—*Trans. Ent. Soc. Lond.*, lxxx, pt. 2, pp. 169–250, 8 pls., 16 pp. refs. London, 31st December 1932.

This valuable monograph consists primarily of a revision of the species of the genera *Plodia* and *Ephestia* (of which *Strymax* is considered a subgenus), and was published with the assistance of a grant made by the Empire Marketing Board in view of the increasing importance of the larvae of some of the species as pests of stored products.

Descriptions are given of the genera and many of the species, showing their synonymy, distribution and food-habits in some cases, together with a key to the species and a list of them, with their synonyms. This list includes references to the original description and type locality of the species that have not been examined and redescribed. The bionomics and characters of the immature stages of the species that infest stored products are discussed. An appendix is devoted to a review of the recorded natural enemies and diseases of the early stages of these moths, and includes details of their synonymy and distribution and notes on the habits of some of the parasites.

WILKINSON (D. S.). **A Revision of the Ethiopian Species of the Genus** *Apanteles* (**Hym. Bracon.**).—*Trans. Ent. Soc. Lond.*, lxxx, pt. 2, pp. 301–344, 1 pl. London, 31st December 1932.

The species bred from hosts of economic importance are: *Apanteles belliger*, Wlkn., from the Noctuid, *Cirphis unipuncta*, Haw., in Mauritius; *A. acraeae*, sp. n., from the Nymphalid, *Acraea acerata*, Hew., on sweet potato in Uganda; *A. sesamiae*, Cam., from the Noctuid, *Busseola* (*Sesamia*) *fusca*, Fuller, in Cape Colony, Uganda and Kenya, *Sesamia cretica*, Led., in the Anglo-Egyptian Sudan, and a Pyralid, *Chilo* sp., in Nyasaland; *A. ruficrus*, Hal., from *Cirphis loreyi*, Dup., and *Sesamia* spp. in the Sudan, and Italian Somaliland; *A. sagax*, Wlkn., from the Pyralid, *Sylepta derogata*, F., in Tanganyika Territory and Uganda; *A. diparopsidis*, Lyle, from *Diparopsis castanea*, Hmps., in South Africa, the Tineid, *Platyedra erebodoxa*, Meyr., in Uganda and *Earias* spp., in Uganda, Nigeria and Northern Rhodesia; *A. coffea*, Wlkn., from the Pyralid, *Thliptoceras octoguttale*, Feld., in the berries of *Tricolysia* sp., and probably from the Tortricid, *Argyroploce* (*Enarmonia*) *batrachopa*, Meyr., but possibly from *T. octoguttale* in coffee berries in Uganda; *A. earterus*, Wlkn., from the Noctuids, *E. insulana*, Boisd., and *D. castanea* in the Sudan; *A. syleptae*, Ferrière, from *S. derogata*, on cotton in the Sudan and Tanganyika Territory; *A. aethiopicus*, Wlkn., from the Arctiid, *Utetheisa pulchella*, L., and the Pyralid, *Antigastra catalaunalis*, Dup., in Italian Somaliland; and *A. africanus*, Cam. (*beneficus*, Vier., *cameroni*, Brues) from Lymantriids, including *Notolophus* (*Orgyia*) *vetustus*, Hmps., in Uganda. *A. africanus*, Vier., *A. capensis*, Cam., *A. testaceolineatus*, Cam., and *A. testaceioventris*, Cam., are considered to be synonyms of *A. maculitarsis*, Cam.

A list of the hosts and an index to the Ethiopian species of *Apanteles* are appended, together with a key to the Ethiopian and Indo-Australian species, as well as a number from the Palaearctic and Nearctic regions, and a list of the species included in it.

GLANVILLE (R. R.). [Report on Locust Control Work in the] **Northern and North-western Circles.**—*Ann. Rep. Dept. Agric. Sierra Leone 1931*, pp. 5–7. Freetown, 1932.

The invasion of *Locusta migratoria migratorioides*, Rch. & Frm., in 1931 was the most serious yet experienced in Sierra Leone. Comparatively little damage was caused to the crops, however, owing to rigorous control measures. The bulk of the rice crop had been harvested before the arrival of the swarms in December 1930, and though in some areas the presence of the hoppers delayed planting, in most cases the rice was sown sufficiently early to ensure a good crop. Swarms had been

reported from all districts by February 1931 and hoppers from about 27th April until the end of June. By the middle of July the hoppers had all been killed or had matured and migrated into French Territory. Of the control measures employed, trenching was the cheapest and most satisfactory when ample labour was available. Sodium arsenite was more effective than Paris green, especially when sprayed directly on to the hoppers. Poison baits of Paris green, sawdust and salt were not usually satisfactory, possibly owing to the abundance of alternative food, chiefly grass.

HARGREAVES (E.). **Entomological Work.**—*Ann. Rep. Dept. Agric. Sierra Leone 1931*, pp. 18–20. Freetown, 1932.

Local damage was caused to Liberian coffee in Sierra Leone in 1931 by the Lycaenid, *Deudorix* (*Virachola*) *bimaculata*, Hew., the larvae of which feed on the developing beans, destroying 4–6 berries. Pupation takes place inside the berry, emergence occurring in 11 days in January. Adults have also been observed in November. *Pseudococcus njalensis*, Laing, is prevalent in the base of the inflorescence and among the berries of robusta coffee, causing them and the flowers to fall. It is controlled to a great extent by *Scymnus ornatus*, Sicard, *Rodolia occidentalis*, Wse., the Cecidomyiid, *Triommata coccotroctes*, Barnes, and the larvae of an unidentified Lycaenid. Negative results were obtained in the transmission of mosaic disease of ground-nuts [*Arachis hypogaea*] with leafhoppers, *Halticus tibialis*, Reut., thrips and *Aleurodes* sp., though some evidence of transmission resulted from the feeding of *Aphis laburni*, Kalt. This Aphid was attacked by larvae of the Syrphids, *Paragus borbonicus*, Macq., *P. longiventris*, Lw., and *Xanthogramma* (*Ischiodon*) *aegyptium*, Wied., and the Coccinellid, *Scymnus scapuliferus*, Muls. Defoliators of ground-nuts included *Prodenia litura*, F., and *Lamprosema indicata*, F. *Papilio nireus*, L., was observed defoliating *Citrus*. *Stethorus jejunus*, Csy., was predacious on the eggs of a mite with which negative results were obtained in the transmission of mosaic disease of cassava [*Manihot utilissima*].

Dissections of females from swarms of *Locusta migratoria migratorioides*, Rch. & Frm. [see preceding paper] revealed the presence of the first mature eggs on 4th February. Larvae from eggs deposited in the laboratory on 16th February hatched on 2nd March and became adults of the typical swarming phase on 31st March. Individuals bred in May and June were of the same phase.

Other pests observed included *Phytometra chalcites*, Esp., on cacao, *P. acuta*, Wlk., on banana and tobacco, *Prodenia litura* on tobacco, *Heliothis obsoleta*, F. (*armigera*, Hb.) boring in the stem and attacking the fruit of tomato, *Dacus punctatifrons*, Karsch, in the fruits of tomato and cucumber, and *D. bivittatus*, Big., in the fruits of papaya and cucumber.

PEARSON (R. S.). **Report of the Forest Products Research Board for the Year 1931.**—Med. 8vo, 51 pp., 3 figs., 8 pls. London, H.M.S.O., 1933. Price 3*s*. 6*d*. net.

Research on entomological problems is discussed on pp. 24–29. *Lyctus* spp. (powder post beetles), much of the information on which has previously been noticed [*R.A.E.*, A, xx, 509; xxi, 1], still cause the greatest loss to the hardwood timber and allied trades in Britain and

appear to have been unusually troublesome during 1931. Preliminary results of further experiments on the steam sterilisation of timber [*cf.* xvii, 254] indicate that exposure for several days to a temperature of 125°F. and a relative humidity of 80–100 per cent. [xix, 72] may be sufficient to kill the insects. The larvae showed considerable resistance to heat, which, if not sufficient to kill them, had a prolonged paralysing effect ; the results of exposure to 125°F. and relative humidities of 60 and 80 per cent. could only be ascertained after periods varying from 21 to 43 days. In view of the relation considered to exist between the size of the pores of the timber and its susceptibility to infestation [xvi, 586], the finding is recorded of *Lyctus* in sycamore, willow, and the Australian wood, *Schizomeria ovata*, which is markedly susceptible though it has small pores. The contents of the cells of the sapwood, on which the larvae feed [xix, 73], vary with the age of the timber, and its suitability for their development may therefore be limited to the period during which certain substances, such as carbohydrates, are present within the cells [*cf.* also xx, 454].

Xestobium rufovillosum, DeG. (death watch beetle) has been found to be more numerous in partly decayed willow trees in the neighbourhood of the laboratory than it is in timber from buildings. Old oak and willow trees are the natural habitat of the insect, and experiments still in progress indicate that a comparatively high moisture content and the presence of fungi are necessary for its development in timber, and that even under these optimum conditions, the rate of growth of the larvae is slow, probably occupying 5 or 6 years. Incense, the use of which in churches has been suggested to prevent infestation, had no apparent effect on larvae removed from the wood and exposed to concentrated fumes for periods of up to 2 weeks. No information is available on the cumulative effect of incense, but it seems improbable that its use would have any deleterious effect on the larvae.

JARY (S. G.) & AUSTIN (M. D.). **Department of Entomology** [Report 1931–32].—*J. S.-E. Agric. Coll.*, no. 31, pp. 7–12. Wye, Kent, January 1933.

Notes are given on the insect pests observed during 1931–32, all of which are of common occurrence in south-eastern England, together with a brief review of the work carried out, most of which has already been noticed [*R.A.E.*, A, xx, 552, 553, 661 ; xxi, 90, 110].

MASSEE (A. M.). **Notes on Insect Pests for the Year 1931.**—*19th Ann. Rep. East Malling Res. Sta. 1931*, pp. 51–54, 1 pl. East Malling, Kent, May 1932. [Recd. January 1933.]

Damage caused by pests in 1931 included injury to strawberries planted after hops in Kent. An outbreak of *Tetranychus telarius*, L., on newly planted strawberries in March and April was probably due to the emergence of the mites from hibernation in the soil, to which they had migrated from the hop bines. Similar attacks have been noticed where strawberries have followed black currants. Strawberries planted in ground in which hops had not grown well were infested by *Hepialus lupulinus*, L., the larvae of which bored into the crowns, causing the plants to wilt and die. One or more were present in practically every plant, and the roots of hops in the remaining part of

the garden were heavily infested. The hops had apparently been able to withstand the damage, to which the strawberries ultimately succumbed.

Oviposition by *Phorodon humuli*, Schr. (hop-damson aphis), which usually takes place during the latter part of September and in October, was observed occurring on the spurs of plums up to 12th December.

Rhynchites aequatus, L. [*R.A.E.*, A, xv, 55] is found throughout the south of England, usually on hawthorn [*Crataegus*]. A serious outbreak occurred on several acres of apple in a district in Kent where its alternative food-plants are uncommon. The females bore holes in the developing fruit, sometimes causing as many as 20 or 30 punctures in a single apple, and render the fruit unmarketable. It is doubtful whether these punctures are made for the purpose of oviposition, as examination of large numbers of fruits revealed only some 3 or 4 eggs. *R. coeruleus*,DeG. (apple twig cutter), which attacks various pomaceous trees, has recently been observed damaging young apples, being particularly injurious in West Sussex in June, and appears to be becoming of importance on plums. The adults make cuts in the new growth about 3 ins. from the tip and oviposit in the woody tissue of the portion above the cut, which subsequently falls to the ground. The young shoots may all be killed or the growth of the tree checked or rendered uneven. The incubation period is short, and the larvae tunnel in the pith of the withered shoots and mature in about 14 days. In the laboratory, pupation occurs in the ground and the adults emerge at the end of August, hibernating in a small compact cell in the soil.

MASSEE (A. M.). **A simple Method of Forecasting Insect Attacks in Orchards previous to the Spraying Season.**—*19th Ann. Rep. East Malling Res. Sta. 1931*, pp. 78–80. East Malling, Kent, May 1932. [Recd. January 1933.]

In view of the limited period during which sprays can be applied effectively against orchard pests in spring, a method is described by which the time and place of outbreaks may be predicted. Random samples of well-developed shoots, 18–24 ins. long, should be collected from different parts of the trees from the outside of the orchard and in a diagonal line across it, about the second week of February being the most suitable time for apples, pears, plums and cherries. The shoots should be labelled to denote their position in the orchard and placed in glass jars containing sand and water in a warm sheltered situation, preferably a hothouse. They should be lightly sprayed with water every alternate day and the ends of the stems should be cut occasionally to allow the passage of water and to remove any growth of fungus. The jars should be kept filled with water. The buds begin to open in a few days, and their growth is accompanied by the development of the insect population on the twigs and shoots, thus making it possible to forecast outbreaks some weeks in advance and prepare to apply control measures at the proper time.

The time at which the routine lime-sulphur spray should be applied against the black currant gall mite [*Eriophyes ribis*, Nal.] on black currants may be determined by placing infested shoots, preferably those affected with " big bud " at the apex, in a jar containing sand and water under natural conditions and examining them until mites are observed on the exterior of the buds, at which time the bushes in the field will be at the correct stage for spraying.

Steer (W.). **The Control of the Raspberry and Loganberry Beetle by Means of Derris.**—*19th Ann. Rep. East Malling Res. Sta. 1931*, pp. 81–84, 1 diagr. East Malling, Kent, May 1932. [Recd. January 1933.]

Notes are given on the bionomics of *Byturus tomentosus*, F., on raspberries, loganberries and blackberries [*R.A.E.*, A, xix, 638] and its control in Kent by means of a derris spray [xx, 331].

MacDougall (R. S.). **Insect Pests—No. xvii.**—*Scot. J. Agric.*, xvi, no. 1, pp. 64–72, 1 pl., 4 refs. Edinburgh, January 1933.

This part of a series of papers on insect pests in Britain [*R.A.E.*, A, xx, 710, etc.] completes the section dealing with the Rhynchota. General notes are given on the habits of Aphids, and the life-history of *Aphis rumicis*, L., is outlined as typical of a species having a variety of food-plants. The Psyllids, Aleurodids and Coccids are then briefly dealt with, the life-history of *Lepidosaphes ulmi*, L., being given as typical of the last-named. General notes are given on the sub-order Heteroptera.

Dingler (M.). **Chemische Bekämpfung der Spargelfliege.** [Chemical Control of the Asparagus Fly.]—*Anz. Schädlingsk.*, ix, no. 1, pp. 1–9, 8 figs. Berlin, January 1933.

In laboratory tests with contact dusts against adults of the asparagus fly, *Platyparea poeciloptera*, Schr., in Germany [*R.A.E.*, A, xix, 513], a proprietary one containing nicotine was the most rapid in action, and was particularly so when the carrier with which it was combined consisted of 1 part gypsum and 3 parts calcium carbonate. Field tests with this dust are described, and it is concluded that if it is applied daily, except on rainy days, for 3 weeks beginning when the flies appear in May, and both 2- and 3-year-old fields are dusted, the plants most open to attack will be protected.

Blunck (H.). *Bourletiella signata* (**Nic.**) **Ågren als Gurkenschädling.** [*B. signata* as a Pest of Gherkins.]—*Anz. Schädlingsk.*, ix, no. 1, pp. 9–12, 2 figs., 14 refs. Berlin, January 1933.

In the spring of 1932, the leaves of gherkin seedlings in Schleswig-Holstein were injured by *Bourletiella signata*, Nic. In one case where the attack became serious, it was completely controlled by a single application of a spray containing 0·5 per cent. crude nicotine. Other records of injury to cucurbits by Collembola are briefly reviewed.

Schedl (K. E.). **Auch ein Wort zur Frage Mathematik und Entomologie.** [Another Contribution to the Question of Mathematics and Entomology.]—*Anz. Schadlingsk.*, ix, no. 1, pp. 12–13. Berlin, January 1933.

The author regards it as absolutely necessary to base deductions from biological data on observations made on a large scale and on the most extensive use of statistics. He disagrees with Horn's general criticism of the value of mathematics in biological work [*R.A.E.*, A, xx, 615] and considers that conclusions as to the future course of biological phenomena may be reached by analysis of past events. In work on insect pests the first essential is to collect exact data regarding outbreaks.

SCHMITT (N.). **Ein neues Verfahren zur besseren Ausnutzung des wirksamen Stoffes aus rotenonenthaltenden Pflanzen.** [A new Method for the better Utilisation of the active Substance in Plants containing Rotenone.]—*Anz. Schädlingsk.*, ix, no. 1, pp. 14–15. Berlin, January 1933.

In isolating the active principle of crucifers containing mustard oil, it was noticed that the myronic acid extracted was increased in amount or separated more easily if some of the isolated substance was added to the material containing that substance. A description is given of experiments at Wiesbaden that show this to apply when pure crystallised rotenone is added to the material containing rotenone extracted by ether from powdered derris root and dissolved in acetone, toxicity (to goldfish) being enhanced to a degree far exceeding expectation.

SEDLACZEK (W.). **Verbreitung und Befallsdichte des Schwammspinners im Burgenland im Jahre 1931.** [The Distribution and Density of *Porthetria dispar* in Burgenland in 1931.]—*Zbl. ges. Forstwes.*, lviii, pp. 184–186, 1932.

RIPPER (W.). **Schwammspinnerbekämpfung 1931 u. 1932.** [Measures against *P. dispar* in 1931 and 1932.]—*T.c.*, pp. 187–188. (Abstracts in *Anz. Schädlingsk.*, ix, no. 1, p. 16. Berlin, January 1933.)

Since 1929 *Porthetria dispar*, L., has been increasing in the Burgenland region, Austria, and the first paper describes a plan for the collection of data on the outbreak. In the second it is stated that in spite of control work in the autumn of 1930 and spring of 1931 and the destruction of many of the larvae by *Calosoma* and Tachinids, especially *Phorocera agilis*, R.-D., the number of egg-masses increased by 50 per cent. Instead of continuing collection of the masses, they are being wetted with carbolineum, dyed so as to distinguish those treated.

KÉLER (S.). **Szkodniki roślin rolniczych i ogrodniczych w Wielkopolsce i na Pomorzu w latach 1926, 1927 i 1928.** [Pests of Field and Market-Garden Crops in western Poland in the Years 1926, 1927 and 1928.]—*Prace Wydz. Chor. Roś. państw. Inst. nauk. Gosp. wiejsk. Bydgoszczy*, no. 12, 22 pp., 1 ref. Bromberg, 1932. (With a Summary in English.)

Notes are given on the local distribution and activities of the pests observed in western Poland in 1926–28 on cereals, vegetables and fruit trees. The chief cereal pests were *Cephus pygmaeus*, L., on wheat and rye, *Oscinella* (*Oscinis*) *frit*, L., on wheat, and *Chlorops taeniopus*, Mg., on wheat and barley. The adults of *Melolontha melolontha*, L. (*vulgaris*, F.) were particularly abundant in 1926, defoliating orchard and other deciduous trees, and in 1927 the larvae caused severe damage to vegetables. An outbreak of *Phytometra* (*Plusia*) *gamma*, L., occurred in the first half of July 1928 on a variety of vegetables, and in many instances 100 per cent. of the peas were destroyed. In a number of localities the mature larvae were killed at the end of July by the fungus, *Entomophthora plusiae*. Other injurious pests included *Pieris brassicae*, L., on cruciferous vegetables and root crops, *Cydia* (*Carpocapsa*) *pomonella*, L., on apples, and *C.* (*Grapholitha*) *funebrana*, Tr., on plums.

MARLATT (C. L.). **Report [1931–1932] of the Chief of the Bureau of Entomology.**—38 pp. Washington, D.C., U.S. Dept. Agric., 1932.

This is a review of the work carried on in the various divisions of the United States Bureau of Entomology against insect pests during the year ending 30th June 1932. Most of the information given has already been noticed from other sources.

The most important parasites imported into the United States from Europe during the past two years for liberation in the various peach growing sections against the oriental fruit moth [*Cydia molesta*, Busck] are *Pristomerus vulnerator*, Panz., *Ascogaster quadridentata*, Wesm., and *Trichogramma euproctidis*, Gir. Liberations of *T. minutum*, Riley, in a pecan grove in Florida at the rate of 6,000 to a tree appeared to reduce infestation by the nut case bearer [*Acrobasis caryae*, Grote] by 43 per cent. *Perisierola cellularis* var. *punctaticeps*, Kieff., a particularly valuable native parasite of *A. caryae*, has been found to be absent in the pecan section of Georgia, and steps have been taken to introduce it there. The principal Dipterous parasite of the Japanese beetle [*Popillia japonica*, Newm.] is *Centeter cinerea*, Aldr., which is now established over an area of about 179 sq. miles. *Tiphia popilliavora*, Rohw., the important Hymenopterous parasite, has now spread over about 4 sq. miles in the Riverton area. Females have been recovered at 43 of the 199 points of liberation. *Microbracon brevicornis*, Wesm., and *Pimpla* (*Exeristes*) *roborator*, F., have been sent to the Presidio laboratory in Texas in the hope that they might attack the larvae of the pink bollworm [*Platyedra gossypiella*, Saund.], which they are known to parasitise in the Old World. Shipments from Massachusetts included *Apanteles solitarius*, Ratz., and *Eupteromalus nidulans* (Först.) Thoms. [*cf. R.A.E.*, A, xviii, 151], which were sent to the State of Washington for use against the satin moth [*Stilpnotia salicis*, L.].

QUAYLE (H. J.). **Biology and Control of Citrus Insects and Mites.**—*Bull. Calif. Agric. Expt. Sta.*, no. 542, 87 pp., 42 figs., 21 refs. Berkeley, Calif., November 1932.

This bulletin supersedes earlier ones now out of print and contains the most recent information on the biology and control of the insects and mites attacking *Citrus* in California, with a view to stimulating growers to take a practical interest in the application of control measures, which in the past have been largely left to official and other agencies. A key to the pests is given, based partly on the injury caused, and they are then dealt with individually, the information on biology including notes on natural enemies in most cases. The control by fumigation or oil sprays of the various species of Coccids working individually or in association is discussed in some detail.

GILMER (P. M.). **The Entrance of Codling Moth Larvae into Fruit, with special Reference to the Ingestion of Poison.**—*J. Kansas Ent. Soc.*, vi, no. 1, pp. 19–25, 1 ref. McPherson, Kans., January 1933.

Since the larvae of the codling moth [*Cydia pomonella*, L.] reject the first pieces of skin they cut from fruit [*cf. R.A.E.*, A, xvi, 453], the author undertook experiments to determine the manner in which the arsenic on sprayed apples is ingested. Apples were given a coating of carmine comparable to that on fruit sprayed with lead arsenate at the

rate of 2 lb. to 50 U.S. gals., and the method of entrance of newly hatched larvae was observed, their body contents being examined at intervals. Although carmine was wiped on the pulp from the setae and from the pieces of apple dragged into the cavity made by the larva, the results showed that most of that ingested was probably obtained from the bits of skin and pulp taken into the mouth during the process of entering the fruit, in spite of the fact that they were afterwards ejected. The quantity of carmine ingested indicated that if the material had been lead arsenate, 25–33 per cent. of the larvae would have survived.

PAYNE (N. M.). **A Parasitic Hymenopteron as a Vector of an Insect Disease.**—*Ent. News*, xliv, no. 1, p. 22. Philadelphia, Pa., January 1933.

The author accepts the view that parasitic Hymenoptera that paralyse their hosts may carry disease organisms on their ovipositors. Disease transmission in this way may be of importance if the host is merely paralysed and not devoured, particularly if paralysis is incomplete and the host moves about.

Microbracon hebetor, Say, lays its eggs under or near a larva of *Ephestia kühniella*, Zell., that has previously been stung. The larvae usually feed as external parasites upon the paralysed host, but in some cases it is not completely paralysed, and even if it is, the larvae are not always able to find it. A sporozoan disease caused by *Thelohania ephestiae* occurs amongst the host larvae ; this originates in the ganglia of the central nervous system, and diseased individuals may be recognised by their large heads, small bodies and badly co-ordinated crawling movements.

The following facts suggest that *T. ephestiae* is transferred by *M. hebetor*. The disease cannot be transmitted by the mouth, and diseased larvae can be kept in the same culture dish with healthy larvae without infecting them. The disease follows attack by *M. hebetor*, and the first point of infection is the ganglion pierced by the parasite ; later the sporozoan is found throughout the nervous system and in the fat body.

PAPERS NOTICED BY TITLE ONLY.

BARTHOLOMEW (P. S.). **Six new Species of Aphids, with Records of other Species new to California.**—*Ann. Ent. Soc. Amer.*, xxv, no. 4, pp. 713–727, 2 pls., 2 refs. Columbus, Ohio, December 1932.

TISSOT (A. N.). **Five new Species of *Anuraphis* and *Aphis*.**—*Florida Ent.*, xvi, no. 4, pp. 49–60, 1 pl. Gainesville, Fla., January 1933.

TAKAHASHI (R.). **Three interesting Aphids from the Far East** [new species from Korea and Formosa].—*Stylops*, ii, pt. 2, pp. 27–30, 3 figs. London, 15th February 1933.

TAKAHASHI (R.). **Two new Species of *Eulachnus* Del Guercio (Aphididae)** [on *Pinus* spp. in Pennsylvania and Formosa].—*Proc. Ent. Soc. Wash.*, xxxiv (1932), no. 9, pp. 150–153. Washington, D.C., 23rd January 1933.

LINDINGER (L.). **Beiträge zur Kenntnis der Schildläuse.** [Contributions to the Knowledge of Coccids (including numerous changes in nomenclature).]—*Konowia*, xi, no. 3, pp. 177–205. Vienna, 25th November 1932.

FULLAWAY (D. T.). **Synopsis of the Hawaiian Diaspinae (Coccidae)** [with keys].—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp. 93–110, 33 refs. Honolulu, November 1932.

FULLAWAY (D. T.). **Hymenopterous Parasites of the Coccidae, etc., in Hawaii** [list with keys].—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp. 111–120. Honolulu, November 1932.

SWEZEY (O. H.). **The Host Trees of the endemic Cerambycidae in Hawaii.**—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp. 127–140. Honolulu, November 1932.

BEAULNE (J. I.). **Longicornes nuisibles aux végétaux ligneux du Canada** [list of 233 beetles and the plants they attack].—*Nat. canad.*, lix, nos. 10–11, pp. 196–203, 219–222. Quebec, 1932.

HARTZELL (A.). **The Relation of Spreading and Tracheal Penetration to the Efficiency of Contact Insecticides.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 60–66, 10 refs. Yonkers, N.Y., 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xix, 267.]

FELT (E. P.). **The Effect of certain important Insects** [*Galerucella luteola*, Müll., *Plagiodera versicolora*, Laich., and *Popillia japonica*, Newm.] **on Trees.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 66–73. Yonkers, N.Y., 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xx, 284.]

FELT (E. P.) & BROMLEY (S. W.). **Insecticides and Fungicides for Ornamentals.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 115–119. Yonkers, N.Y., 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xix, 349 ; xx, 419.]

HADLEY (C. H.). **The Japanese Beetle** [*Popillia japonica*, Newm.] **Situation in 1931.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 121–124. Yonkers, N.Y., 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xx, 426, etc.]

BURGESS (A. F.). **Some Results secured from Gipsy Moth** [*Porthetria dispar*, L.] **Control and Extermination Work.**—*Proc. 7th Nat. Shade Tree Conf.*, pp. 126–128. Yonkers, N.Y., 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xviii, 681 ; xx, 426.]

FRIEND (R. B.). **Birch Leaf Miner** [*Fenusa pumila*, Klug, in Connecticut].—*Proc. 7th Nat. Shade Tree Conf.*, pp. 133–134. Yonkers, N.Y., 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xix, 349.]

WORTHLEY (H. N.). **A Report of Further Experiments with chemically-treated Bands for Codling Moth** [*Cydia pomonella*, L.] **Control.**—*Pennsylvania St. Hort. Ass. News*, ix, no. 1, pp. 14–22. State Coll., Pa., March 1932. [Recd. January 1933.] [*Cf. R.A.E.*, A, xxi, 69.]

BEALL (G.). **The Use of a modified McIndoo Olfactometer for the European Earwig,** *Forficula auricularia* **(Dermap.).**—*Ent. News.*, xliv, no. 1, pp. 6–10. Philadelphia, Pa., January 1933.

FRANSSEN (C. J. H.). **De beteekenis van** *Apis indica* **als bloembestuivend insect.** [*A. indica*, F., as a Pollinator.]—*De Bergcultures*, vi, no. 52, pp. 1417–1432, 14 refs. Batavia, 1932.

WILLIAMS (F. X.). **Notes on a small Collection of Philippine Weevils that feed in the fleshy Receptacles or " Fruits " of wild Figs.**—*Proc. Hawaii. Ent. Soc.*, viii, no. 1, pp 193–195, 1 ref. Honolulu, November 1932.

ANDRÉ (M.). **Le " Bou-Faroua," acarien** [Tetranychid] **nuisible au dattier en Algérie.**—*Rev. Bot. appl. Agric. trop.*, xii, no. 135, pp. 940–949, 4 figs., 4 refs. Paris, November 1932. [*Cf. R.A.E.*, A, xx, 267, 671.]

KEMNER (N. A.). **Zwei Termiten aus Sinai, mit Beschreibung der neuen Art** *Kalotermes* [*Calotermes*] *sinaicus*.—*Ent. Tidskr.*, liii, no. 2–3, pp. 87–92, 1 fig., 18 refs. Stockholm, 1932.

KEMNER (N. A.). **Neue Termiten aus der orientalischen Region. I–II.**—*Ent. Tidskr.*, liii, no. 2–3, pp. 133–155, 8 figs. Stockholm, 1932.

[KAZYAKINA-VINOGRADOVA (V. N.).] **Казякина-Виноградова (В. Н.). Key to Garden** [chiefly orchard] **Pests based on the Damage caused.** [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 2, pp. 129–142, 36 figs. Leningrad, 1932.

FAES (H.) & BOVEY (P.). **Sur une invasion dans certaines maisons du canton de Vaud de la chenille de** *Paidia murina*, **Hb.**—*Act. Soc. helvét. Sci. nat.*, 1931, p. 336. La Chaux-de-Fonds, 1931. [Recd. December 1932.] [*Cf. R.A.E.*, A, xxi, 40.]

KÜHN (A.). **Entwicklungsphysiologische Wirkung einiger Gene von** *Ephestia kühniella*. [The developmental-physiological Effect of some Genes of *E. kühniella*, Zell.]—*Naturwissenschaften*, xx, no. 51, pp. 974–977, 2 figs., 4 refs. Berlin, December 1932.

STANLEY (J.). **A mathematical Theory of the Growth of Populations of the Flour Beetle,** *Tribolium confusum*, **Duv.**—*Canad. J. Res.*, vi, no. 6, pp. 632–671, 9 figs., 15 refs. Ottawa, 1931. **ii. The Distribution by Ages in the Early Stages of Population Growth.**—*Op. cit.*, vii, no. 4, pp. 426–433, 1 fig., 2 refs. Ottawa, 1932.

JANISCH (E.). **The Influence of Temperature on the Life-history of Insects.**—*Trans. Ent. Soc. Lond.*, lxxx, pt. 2, pp. 137–168, 9 graphs, 15 refs. London, 31st December 1932.

BRISTOWE (W. S.). **Insects and other Invertebrates for Human Consumption in Siam.**—*Trans. Ent. Soc. Lond.*, lxxx, pt. 2, pp. 387–404, 1 fig. London, 31st December 1932.

WAINWRIGHT (C. J.). **The British Tachinidae (Diptera). First Supplement.**—*Trans. Ent. Soc. Lond.*, lxxx, pt. 2, pp. 405–424, 19 figs., 3 refs. London, 31st December 1932. [*Cf. R.A.E.*, A, xvi, 480.]

GRANDORI (R.) & SOMENZI (E.). **Esperimenti di moritura delle crisalidi del Filugello mediante l'acido cianidrico.** [Experiments in Killing the Pupae of *Bombyx mori*, L., by Means of Hydrocyanic Acid Gas.]—*Boll. Lab. Zool. agrar. Bachic. Milano*, iii, no. 2, pp. 1–20. Milan, 1932.

PEZZINI (I.). **Ricerche sul comportamento del** *Nosema bombycis* **Nägeli nell'uovo del** *Bombyx mori* **L. durante lo sviluppo embrionale.** [Investigations on the Behaviour of *N. bombycis* in the Egg of *B. mori* during embryonal Development.]—*Boll. Lab. Zool. agrar. Bachic. Milano*, iii, no. 2, pp. 21–42, 2 pls., 11 refs. Milan, 1932.

STRONG (L. A.). **Report [1931–32] of the Chief of the Plant Quarantine and Control Administration.**—63 pp. Washington, D.C., U.S. Dept. Agric., 1932.

The activities of the Plant Quarantine and Control Administration for the year ending 30th June 1932 are reviewed, the insect pests dealt with being the gipsy, brown tail and satin moths [*Porthetria dispar*, L., *Nygmia phaeorrhoea*, Don., and *Stilpnotia salicis*, L.], the European corn borer [*Pyrausta nubilalis*, Hb.], the Japanese beetle [*Popillia japonica*, Newm.], the pink bollworm [*Platyedra gossypiella*, Saund.], the thurberia weevil [*Anthonomus grandis thurberiae*, Pierce], the Mexican fruit worm [*Anastrepha ludens*, Lw.], the date-scale [*Parlatoria blanchardi*, Targ.] and the narcissus bulb flies [*Merodon equestris*, F., and *Eumerus* spp.].

Pink-Bollworm Quarantine No. 52. Revision of Quarantine and Regulations. Notice of Quarantine No. 52 (revised). Revised Rules and Regulations supplemental to Notice of Quarantine No. 52.—*U.S. Dept. Agric., B.P.Q., Q. 52*, 6 pp. Washington, D.C., 29th October 1932.

This revision of the quarantine and regulations in respect of *Platyedra* (*Pectinophora*) *gossypiella*, Saund. [*R.A.E.*, A, x, 594] adds six counties of north-central Florida to the regulated areas and makes provision for the compression of cotton lint and the crushing of cottonseed produced and ginned therein.

Modification of Date-Palm Scale Insect Quarantine and Regulations. Amendment No. 1 to Notice of Quarantine No. 6, and to the Regulations supplemental thereto.—*U.S. Dept. Agric. B.P.Q., Q. 6*, 1 p. Washington, D.C., 1st December 1932.

This amendment to the quarantine and regulations issued 1st March 1913 to prevent the spread in the United States of scale insects attacking date palms removes from consideration *Phoenicococcus marlatti*, Ckll., as this species has been found to be of no commercial importance. Evidence of freedom from *Parlatoria blanchardi*, Targ., will hereafter constitute the basis for issuing Federal permits for transport of date palms or date-palm offshoots from the regulated areas.

Modification of Regulations of the Fruit and Vegetable Quarantine of Puerto Rico, Quarantine no. 58.—*U.S. Dept. Agric., B.P.Q., Q. 58*, 1 p. Washington, D.C., 1st January 1933.

This amendment to the regulations restricting the import of fruit and vegetables from Porto Rico into the United States [*R.A.E.*, A, xiii, 435] provides for the admission of a considerable number of fruit and vegetable products, a list of which is given, additional to the limited number listed in the original regulations.

DOZIER (H. L.). **Descriptions of new Mymarid Egg Parasites from Haiti and Puerto Rico.**—*J. Dept. Agric. Puerto Rico*, xvi, no. 2, pp. 81–91. San Juan, P.R., April 1932. [Recd. January 1933.]

The new species described from Haiti include : *Gonatocerus cubensis*, reared from a consignment of *Citrus* foliage received from Cuba infested

with *Aleurocanthus woglumi*, Ashby, parasitised by *Eretmocerus serius*, Silv.; *Anagrus empoascae*, from eggs of *Empoasca fabalis*, DeLong; *Anaphes bicolor*, from bean foliage infested by *E. fabalis*; and *Camptoptera minutissima*, from avocado foliage infested by *Empoasca minuenda*, Ball. *Alaptus borinquensis*, sp. n., is described from *Asterolecanium pustulans*, Ckll., in Porto Rico. *Anagrus flaveolus*, Waterh., is recorded as being reared from the eggs of *Peregrinus maidis*, Ashm., and apparently the same species from those of *Stenocranus* (*Saccharosydne*) *saccharivorus*, Westw., in Haiti. In discussing the determination of the parasite of *S. saccharivorus* as *A. flaveolus*, the author states that the previous identifications of this parasite as *A. armatus*, Ashm., in Haiti and Porto Rico [*cf. R.A.E.*, A, iii, 26, 134] are undoubtedly in error.

Dozier (H. L.). **Notes on the Genus *Aneristus* Howard with Descriptions of new Species (Hymenoptera: Chalcidoidea).**—*J. Dept. Agric. Puerto Rico*, xvi, no. 2, pp. 93–102, 2 pls., 3 figs. San Juan, P.R., April 1932. [Recd. January 1933.]

The status, scope and distinguishing characters of the Aphelinid genus *Aneristus*, of which *Prococcophagus* is considered a synonym, are discussed, with a key to the species based on the external characters of the females, the males of the majority being unknown, and a list showing their hosts, all of which are non-Diaspine Coccids, and distribution. The new species described by the author are: *A. mangiferae*, reared from *Coccus mangiferae*, Green, in Haiti, from *Saissetia coffeae*, Wlk. (*hemisphaerica*, Targ.) in Santo Domingo, and from *Citrus* material received in Haiti from Cuba during the course of releases of *Eretmocerus serius*, Silv. [against *Aleurocanthus woglumi*, Ashby]; and *A. hispaniolae* from *Ceroplastes giganteus*, Dozier, and *A. asterolecanii* from *Asterolecanium aureum*, Boisd., both in Haiti. Girault's description of *A. youngi*, which appeared in a privately published paper, is quoted. It has been reared from *Ceroplastes* sp., *S. coffeae* and *Coccus hesperidum*, L., in Louisiana.

Dozier (H. L.). **Two important West Indian Seed-infesting Chalcid Wasps.**—*J. Dept. Agric. Puerto Rico*, xvi, no. 2, pp. 103–112, 5 figs., 2 refs. San Juan, P.R., April 1932. [Recd. January 1933.]

The larva, pupa and adults of both sexes of *Tanaostigma haematoxyli*, sp. n., are described from Haiti, where it infests the seeds of logwood (*Haematoxylon campechianum*), which is the principal honey plant and is also of value as an export for the dye industry. The deposition of the eggs in the young tender pods causes a gall-like deformation of the seeds and a thickening along the centre of the pod, and the presence of a larva within each seed results in the loss of 90 per cent. of the annual seed crop. As the period of flowering of logwood is irregular and varies in different regions, it appears that *T. haematoxyli* may carry over from one season to the next without difficulty. Observations in various districts in 1930 revealed the presence of adults in January and February, and in 1931 that of immature larvae in January and adults in February and March. In the laboratory, this Eupelmid was observed to be parasitised to the extent of 6·75 per cent. by *Horismenus* sp. and *Eupelmus* sp.

A redescription is given of the female of *Bephrata cubensis*, Ashm., which attacks *Anona* spp. in various parts of the West Indies and in

Florida and has been reared by the author in Haiti and Porto Rico. This Eurytomid oviposits in the young developing fruits, the larvae feeding within the seeds. As with *T. haematoxyli*, the pupal stage is passed within the fruit.

DU PASQUIER (R.). **Principales maladies parasitaires du théier et du caféier en Extrême-Orient.**—*Bull. écon. Indochine*, xxxv, pp. 589B–618B, 5 figs., 3 pls., many refs. Hanoi, 1932.

This third paper of a series [*R.A.E.*, A, xx, 718 ; xxi, 27] deals with Diptera, ants, crickets, termites and Rhynchota, and contains coloured illustrations of the following :—the Capsid, *Helopeltis theivora*, Waterh., which often causes severe damage to tea in Assam and Bengal, and also occurs in Java, Sumatra and Indo-China ; the Pentatomid, *Poecilocoris latus*, Dall., which attacks the flowers and fruits of tea in Indo-China, India and Java ; the Jassid, *Empoasca flavescens*, F., which feeds on the young shoots of tea in Indo-China, Assam, Bengal, Formosa and Japan ; the Flatid, *Lawana candida*, F., which sometimes causes injury to coffee in Java, though of minor importance in Indo-China, and occasionally occurs on tea ; and the Aphid, *Toxoptera aurantii*, Boy. (*theaecola*, Buckt.), which attacks coffee and tea in India, Ceylon and Java and often causes serious damage to the latter in Indo-China. Other pests discussed in some detail are the Gryllids, *Brachytrypes portentosus*, Licht., and *Gryllus mitratus*, Burm. (*occipitalis*, Serv.), which destroy coffee and tea seedlings in Indo-China ; and *Helopeltis antonii*, Sign., which is an important pest of tea in Java and sometimes in southern India and Ceylon, but is seldom injurious in Indo-China.

Oscinis theae, Big., and *O. coffeae*, Konings., the larvae of which mine in the almost mature leaves of tea and coffee plants respectively, are very common in Indo-China, India, Ceylon and the Netherlands Indies, but the injury caused is seldom of importance.

TAKAI (S.). **On a Weevil infesting the Seeds of** *Brassica campestris*. [*In Japanese.*]—*Insect Wld.*, xxxvi, no. 10, pp. 338–341. Gifu, October 1932.

A weevil that has been variously identified as *Rhinoncus bruchoides*, Hbst., and *Ceuthorrhynchus albosuturalis*, Roel., attacks various crucifers in the central part of Honshu, causing serious damage to *Brassica campestris*. There is one generation a year, the weevils emerging in June and the early part of July. After hibernation they resume activity in late March and feed on the flower buds. The eggs are laid at the end of April, usually one egg in a seed-case, and hatch in 9–14 days, the larvae feeding on the seeds and maturing in about 8 days. The pupal stage lasts 5 or 6 days.

NOGUCHI (T.) & KAWADA (K.). **New Insect Pests of** *Citrus* **collected in 1930 and 1931.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 7, pp. 510–512. Tokyo, July 1932.

Brief notes are given on about 20 insects that attack *Citrus* in Japan, some of which have not yet been identified. They include two species of thrips, the moths, *Acidalia steganioides*, Butl., and *Arctornis chrysorrhoea*, L. (*Porthesia similis*, Fuess.), and the beetles, *Chlorophorus motschulskyi*, Ganglb., *Malachius xantholoma*, Kies., and *Telephorus* spp. *M. xantholoma* and *Telephorus* feed on the flowers and cause the so-called " injured fruits."

TANAKA (K.). **A List of Insect Pests of *Citrus* in Japan.** [*In Japanese.*]—*J. Plant Prot.*, xix, no. 8, pp. 570–585. Tokyo, August 1932.

A list is given of some 270 species of insects now known to occur on *Citrus* in Japan, Formosa, Korea and the Loochoo Islands.

SHINJI (O.). **Miscellaneous Notes on Aphids, with Descriptions of two new Genera.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 118–124, 1 fig. Tokyo, July 1932.

Notes are given on the alternate food-plants of various Aphids in Japan. *Prociphilus kuwanai*, Monzen, and *P. ushikoroshi*, Shinji, pass the summer on the roots of larch (*Larix*) and the winter on pear and *Photinia villosa* respectively. *Aphis glycines*, Mats., injures soy beans in summer, spending the winter on *Achyranthes bidentata*; and *Akkaia polygoni*, Takah., is found on *Polygonum* in summer and on *Rhododendron* in winter. *Tuberocorpus onigurumi*, gen. et sp. n., is described as attacking walnut (*Juglans*), and *Neocavariella*, gen. n., is erected for *Cavariella araliae*, Takah.

SAKAI (K.). **On the Increase and Decrease in a Year of the Enemies of Rice Leafhoppers near Oita, Kyushu. Preliminary Report.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 3, pp. 124–127. Tokyo, July 1932.

A list is given of the natural enemies of Homoptera infesting rice near Oita in Kyushu, with very brief notes on them. They are mostly those recorded by Esaki & Hashimoto [*R.A.E.*, A, xviii, 555; xix, 339; xx, 380], and include several spiders, a mite, the Nematode, *Agamermis unka*, and the fungi, *Entomophthora delphacini* and *Beauveria* sp.

IMAMURA (S.). **Mermithidae parasitic in *Chilo simplex*, Butl., and Leafhoppers. 2.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, pp. 176–180, 6 figs. Tokyo, September 1932.

In this continued paper [*R.A.E.*, A, xx, 495], a description is given of the Nematode, *Agamermis unka*, which is a parasite in *Nilaparvata oryzae*, Mats., and *Sogata furcifera*, Horv., on rice in Japan.

OKAJIMA (G.) & TAKEDA (T.). **Biological Studies of *Cnidocampa flavescens* Wlk.** [*In Japanese.*]—*Sci. Bull. Kagoshima Agric. Coll.*, no. 10, reprint 63 pp., 8 pls., 8 figs. Kagoshima, July 1932.

The Limacodid, *Cnidocampa flavescens*, Wlk., which is widely distributed in Japan, has been well known since 1712 owing to its peculiar cocoon. It is polyphagous and has been recorded from some 58 plants belonging to 22 different families, including a variety of fruit trees and other cultivated plants. The adults emerge in the second half of May or early in June, and the eggs are laid, usually singly, at night soon after emergence. The larvae, the hairs of which are poisonous, spin cocoons attached obliquely to stems or branches in July but do not pupate until the following spring. The pupae in the cocoons can be destroyed by exposure to a temperature of 71°C. [159·8°F.] for 15 minutes. A Tachinid, *Chaetexorista* sp., is parasitic in the larvae, sometimes attacking 60·5 per cent.

SHIBATA (K.). **The Ecology of subterranean Insects. I. Studies on the physical Factors affecting the Vitality of subterranean Insects.** [*In Japanese.*]—*Trans. Nat. Hist. Soc. Formosa*, xxii, no. 118–119, pp. 50–65, 7 figs. Taihoku, Formosa, April 1932.

An account is given of experiments in which pupae of *Dacus* (*Chaetodacus*) *cucurbitae*, Coq., which is a serious pest of cucurbits in Formosa, were placed in sand the grains of which were 0·3–0·5 mm. in diameter. The percentage of flies that emerged was higher when the sand contained 4 cc. water per 100 gm. than when it was drier or moister than this. The best environment for the pupae was 100 per cent. atmospheric humidity. The percentage of flies emerging increased as the depth of the layer of sand placed over the pupae was reduced.

YOKOYAMA (K.) & KUROSAWA (J.). **On *Eurukuttarus nigriplaga* Wilem., a new Pest of Mulberry.** [*In Japanese.*]—*J. Seric. Sci.*, iii, no. 3, pp. 216–231, 4 figs. Tokyo, August 1932.

Descriptions are given of the adult, pupa and larva of the Psychid, *Eurukuttarus nigriplaga*, Wileman, which feeds on the leaves of mulberry in Japan [*cf.* also *R.A.E.*, A, xv, 641], but is not a serious pest. There is one generation a year, the adults emerging from late September to mid-October. The females, which are apterous, lay about 300 eggs 3–5 days after emergence. The larvae hatch in April or May and pupate in late August or the first half of September.

NAKAYAMA (S.). **Biological Studies on the Dermestid Beetle, *Trogoderma granarium* Everts.** [*In Japanese.*]—*J. Agric. Expt. Sta. Govt.-Gen. Chosen*, no. 18, pp. 1–23, 2 pls., 16 refs. Suigen, Chosen, June 1931. (With a Summary in English). [Recd. February 1933.]

An account is given of the results of investigations on the biology of *Trogoderma granarium*, Everts, as a pest of stored rice, carried out during 1929–30 at Suigen, Korea, under ordinary room temperature [*cf. R.A.E.*, A, xx, 605]. All stages are described. The adults emerge between the latter part of June and the early part of September, but chiefly during July and August, and oviposit among the grains. Hatching occurs in a few days, and the larvae hibernate from October to May. Though they live in the dark, they can be reared in the light without materially prolonging the life-cycle. The adults remain in the pupal case for a few days until the body hardens. Pairing usually begins within 2 or 3 days of emergence, and oviposition follows soon afterwards and continues for several days, 20–30 eggs being laid. In 1930, adults of a second generation emerged in the autumn.

Fumigation is the most satisfactory measure of control, all stages being killed by exposure for 25 hours to 3–4 lb. carbon bisulphide or for 48 hours to 8–16 oz. chloropicrin per 1,000 cu. ft.

NAKAYAMA (S.). **Biological Studies on the Rice-weevil, *Calandra oryzae* Linnaeus.** [*In Japanese.*]—*J. Agric. Expt. Sta. Govt.-Gen. Chosen*, no. 18, pp. 25–69, 2 pls., 114 refs. Suigen, Chosen, June 1931. (With a Summary in English.) [Recd. February 1933.]

Investigations were undertaken during 1928–30 on the biology and control of *Calandra oryzae*, L., at Suigen, Korea, where it is the major

pest of stored grains, particularly rice, wheat, barley and maize. All stages are described, and the larval instars are differentiated by the width of the head capsule. Some of the data given on the life-history are similar to those already noticed [*R.A.E.*, A, xviii, 535 ; xix, 262]. There are usually 3 or 4 generations annually, reproduction, the rate of which varies with the temperature, ceasing during the winter and early spring. The female usually lays a total of about 100 eggs, and the immature stages occur within the grain. The winter may be passed as a larva (except in the first instar), pupa or adult. The adults, however, require specific conditions of moisture, and large numbers migrate from the warehouse and hibernate under sticks, stones, bricks, etc., where such conditions are to be found. They return in search of food in spring.

The larvae and pupae are attacked from early spring to late autumn by the Pteromalid, *Lariophagus distinguendus*, Först., which has many generations a year, the life-cycle lasting about 19 days in the early part of September, but does not effect any appreciable check on infestation. All stages of the weevil may be controlled by fumigation with carbon bisulphide or chloropicrin. The former should be used at the rate of 4–5 lb. liquid to 1,000 cu. ft. for 45 hours in the spring and autumn and 3–5 lb. for 25–30 hours in mid-summer, and the latter at the rate of 1 lb. liquid to 1,000 cu. ft. for 72 hours, or longer if the temperature is below 70°F.

C. sasakii, Takah., is present in a few localities in the south, but is of relatively minor importance as a pest of stored cereals.

JACQUES (C.). **Ennemis et maladies du cocotier en Nouvelle-Calédonie.** —*Rev. agric. Nouv. Calédonie*, 1932, pp. 903–909, 2 figs. Nouméa, 1932.

Serious damage to coconut palms in New Caledonia is caused by *Brontispa froggatti*, Sharp, the adults and larvae of which live among the unopened fronds and often kill the trees. This Hispid may be controlled by shaking a suspension of lead arsenate or nicotine and soap solution into the heart of the leaves of affected trees from a bottle with a perforated cork, this process being repeated at intervals of three months at first, and later every six months. Another important pest is the weevil, *Rhynchophorus* sp., the adults of which oviposit in holes which they make in the base of the leaves or in existing wounds. The larvae mine galleries towards the base of the terminal bud, eventually killing the tree. The methods of control are the capture of the adults at night by means of light traps, the destruction of the infested trees, and the protection of crows, which readily feed on both the adults and larvae. Of less importance is a Tineid [? *Agonoxena* sp., *cf. R.A.E.*, A, xix, 734], the larvae of which gnaw the leaves under the cover of silken cases made chiefly of excreta. The infested foliage dries up and the yield of nuts is reduced.

JARVIS (E.). **Report of Entomologist in charge at Meringa** [1931–32]. —*32nd Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 51–55. Brisbane, 1932.

Campsomeris aureicollis, Lep., introduced into Queensland for the control of sugar-cane grubs [*cf. R.A.E.*, A, xx, 326, etc.], has been found able to complete its development on the larvae of the Dynastid, *Pseudoholophylla furfuracea*, Burm., as well as those of other species

[xx, 247]. Six generations of this Scoliid have been reared from 1st August 1931 to 1st June 1932, the life-cycle averaging 50·5 days. Of two individuals of an indigenous species of *Campsomeris* (near *C. tasmaniensis*, Sauss.) placed in cages containing moist soil and a single grub of *Anomala antiqua*, Gyll. (*australasiae*, Blkb.) in August, one oviposited two days later and the other towards the end of October. In one district 85·7 per cent. mortality of cane-grubs was obtained by soil fumigation with carbon bisulphide, which further supports the view that failures in the past have been due to faulty application rather than to ineffectiveness of the material. The Tachinid, *Ceromasia sphenophori*, Villen., is proving of considerable value in the control of *Rhabdocnemis obscura*, Boisd., on sugar-cane, and 170 individuals were distributed for liberation at various points.

MUNGOMERY (R. W.). **Report of Assistant Entomologist, Bundaberg.**—*32nd Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, pp. 55–57. Brisbane, 1932.

Experimental work during 1931–32 was seriously affected by unfavourable weather conditions. In view of the damage caused to sugar-cane by *Lepidiota frenchi*, Blkb., not more than two ratoon crops should be grown, and infested fields should be ploughed and the grubs collected while they are still feeding [*cf. R.A.E.*, A, xvi, 98]. In areas where damage by frost does not occur, planting in the autumn rather than in the spring will ensure satisfactory establishment and freedom from infestation during the early stages of the growth of the crop. A mortality of 65–80 per cent. of cane grubs was obtained by treating the soil to a depth of 5 ins. with a rotary hoe cultivator [*cf.* xx, 413]. Tests on the effect of fumigants on the growth of sugar-cane confirmed the previous year's results [xx, 187]; plots treated with liquid dichlorobenzene (90 per cent. orthodichlorobenzene) yielded 3·25 tons of cane per acre, those with paradichlorobenzene 6·17, those with carbon bisulphide 14·92, and the untreated ones 14·38.

An unusually large but localised outbreak of the Stratiomyiid, *Metoponia rubriceps*, Macq. [*cf.* xiii, 558], occurred during the year. The eggs were laid in batches of 100 or more just below the surface of the ground and hatched in 15 days at a mean temperature of 61°F. The larvae migrate to within ¼ in. of the surface for pupation. Cultivation of the soil at regular intervals from April to June will cause the destruction by exposure and desiccation of many of the pupae and eggs. Several pests of minor importance have been found attacking sugar-cane in Queensland for the first time, including *Pseudococcus boninsis*, Kuw., *P. brevipes*, Ckll., *Trionymus sacchari*, Ckll., and another species of mealybug probably *P. calceolariae*, Mask. A species of *Margarodes* occurred on the roots, particularly in the forest and poorer scrub soils, and the thrips, *Haplothrips lucasseni*, Kruger, and *Anaphothrips* (*Neophysopus*) *flavicinctus*, Karny, on the foliage.

McDOUGALL (W. A.). **Report of Assistant Entomologist, Mackay.**—*32nd Ann. Rep. Bur. Sugar Expt. Stas. Queensland*, p. 57. Brisbane, 1932.

Damage to sugar-cane by Lamellicorn grubs during 1931–32 was unexpectedly severe, being chiefly caused to ratoon cane. Most of the injury occurred on comparatively new lands adjacent to scrubby creeks, and *Lepidoderma albohirtum*, Waterh., was recorded from many

localities for the first time. Larvae of the Cistelid, *Dimorphochilus pascoei*, Macl., and the Tenebrionid, *Dystalica mackayensis*, Cart., have been taken in various fields of cane. An Elaterid, *Lacon* sp., caused fairly heavy damage during the early part of the year. The life-cycle, which was thought to occupy at least two years, has been found to require only one. Oviposition continues over a long period, and this partly explains the finding of various instars of this wireworm together in individual fields. The older larvae are able to withstand lack of moisture and absence of food for a much longer period than the younger ones, which are present from January to March and require a damp environment. Feeding may continue as late as October. Experiments have shown that if low-lying infested fields are drained during the wet season, immediately prior to planting, sugar-cane can be established successfully.

Subramanya Iyer (T. V.). **A new Contrivance for the Control of the early Stages of the Jola Grasshopper,** *Colemania sphenarioides*, **Bol.** —*J. Mysore Agric. Exptl. Un.*, xiii, no. 1, pp. 11–13, 2 pls. Bangalore, 1932.

Colemania sphenarioides, Bol., reappeared as a pest of *Sorghum*, *Eleusine coracana* and other cereals in northern and north-western Mysore in 1924 after a period of about 14 years, and by 1928 was causing severe damage, necessitating the abandonment of the sowing of *Sorghum* over large areas. Bagging was not satisfactory on the young crop, and a trap consisting of a horizontal wooden frame about $6 \times 1\frac{1}{2}$ ft., to one side of which is fixed a similar vertical one, the frames being covered with tarred matting and drawn over the field on wheels, proved fairly successful Modifications were effected in 1929, the structure being made of angle iron and thin sheets of zinc, with the addition of a standard by which the angle of the trap could be altered slightly according to the height of the crop. A large cloth bag attached over the back of a space left between the vertical and horizontal parts of the trap caught the insects striking the vertical one, thus dispensing with the use of tar or other adhesives, which required constant renewal. In extensive trials this method proved as effective as bagging, and with the use of two bullocks one acre could be covered in about an hour, whereas 4 men dragging a bag by turns cover less than this in one day.

Misra (C. S.). **The Green Peach-Aphis** (*Myzus persicae* **Sulz.**) **and a new Pyralid Mango Defoliator** (*Orthaga mangiferae* **sp. n.**).—*Ind. J. Agric. Sci.*, ii, pt. 5, pp. 536–541, 3 pls., 21 refs. Calcutta, October 1932.|

A severe outbreak of *Myzus persicae*, Sulz. (green peach aphis) occurred suddenly in the fruit-growing region of northern Bihar in 1930, most of the peach trees being severely infested with nymphs and winged and wingless viviparous females by the middle of March. The young nymphs established themselves for preference about the petioles and the mid-ribs of the new leaves ; they were also found on young fruits and beneath the flower buds. The infested leaves became pitted, curled, and seared and the young fruits shrivelled, both dropping prematurely. When infestation occurred during flowering, hardly any fruits were formed. At the end of April the temperature rose suddenly and the winged and wingless females were observed leaving the trees,

and by mid-May the latter were almost free from infestation. The infested trees attracted many Syrphids and Coccinellids, but none of these produced any appreciable control. *M. persicae* can multiply rapidly at temperatures lower than those necessary for the reproduction of its insect enemies. In tests of insecticides, the best results were obtained with a tobacco decoction containing soft soap at the rate of 1 lb. to 20 gals. This cleared the trees within 12 hours when applied before the leaves curled.

An outbreak of the Pyralid, *Orthaga mangiferae*, sp. n., the larva and adult of which are briefly described, occurred on mango trees near Pusa between August and November 1931. The larvae fed gregariously on the leaves, which they webbed together, pupating in the network of webs.

SMEE (C.) & LEACH (R.). **Mosquito Bug the cause of Stem Canker of Tea.**—*Bull. Dept. Agric. Nyasaland*, N. S. no. 5, 7 pp., 3 pls. Zomba, December 1932.

For some years it was supposed that gnarled stem canker of tea in Nyasaland resulted from attack by one or more fungi, but since 1930 it has been shown that the initial cause is the feeding of the Capsid, *Helopeltis bergrothi*, Reut. (tea mosquito bug) [*cf. R.A.E.*, A, xviii, 255].

The nymphs and adults suck the cell sap from the young leaves and green shoots, cankers resulting in the majority of cases on the latter. The first sign that one will be formed is a faint water-soaked mark or a faint brown streak, which sometimes appears even while the insect is feeding. Under the bark a dark brown stain may be found on the inner green wood. This does not extend with the growth of the shoot, but purplish-black sunken spots appear on the outside of the stem ; it is at this time that the various fungi that are practically always associated with later cankerous conditions probably establish themselves. As the stem continues to grow, callus lips are formed at the sides of the wounds, and finally the bark cracks and flakes away and the typical malformed stem with withered drooping leaves is produced. The girdling effect interferes with the vascular system and causes the dying back of the shoots at a variable time after the actual attack ; the interval is about four weeks at the beginning of the season but much longer when the bushes are not actively growing, though even so, the shoots generally die off during the dry season.

H. bergrothi breeds throughout the year, development being most rapid in the early part of the season and becoming slower in the dry weather. The degree of infestation varies considerably from year to year and bears little relation to the amount of damage. The cankers, however, vary in size with the stage of development of the bugs, one individual eventually having the capacity to bring about the death of a shoot in one night. Water-logged hollows, slopes with underlying water pans and sites surrounded by bush would appear to be favourable to the injury from canker, for in these situations the Capsid remains active for a long period and the plants are growing under conditions that render them particularly susceptible to attack. Careful drainage and clearance of surrounding bush is advisable in the preparation of nursery sites, and there should also be sufficient space for free circulation of air and maintenance of equable temperature and humidity. The only reliable direct method of control is hand collection of the bugs,

which is most successful in the early morning when they are feeding on the upper parts of the plant and are easily observed ; they may be found close to any fresh pale green feeding marks on the foliage. In the nurseries, collection should start at the beginning of the season, and in the gardens at the first sign of Capsid activity.

Bagnall (R. S.). **A Contribution towards a Knowledge of the Thysanopterous Genus** *Haplothrips* **Serv.**—*Ann. Mag. Nat. Hist.*, (10) xi, no. 63, pp. 313–334. London, March 1933.

Among the new species described are *Haplothrips dolichothripoides* on seedling cotton, and *H. sorghi* and *H. sorghicola* on *Sorghum*, all from the Anglo-Egyptian Sudan.

di Cairano (V.). **L'Invasione delle Cavellette in Tripolitania nel 1932.**—*Rass. econ. Colon.*, 1932, no. 9–10, reprint 46 pp., 29 pls., 1 map. Rome, 1932.

An invasion of Tripolitania by *Schistocerca gregaria*, Forsk., occurred in 1932 on an unprecedented scale, the swarms spreading into the coastal zone. This may have been partly due to an unusually abundant winter rainfall producing very good vegetation in the steppes. The first swarms came from southern Tunisia about the middle of March, and the locusts then gradually spread over practically the whole northern part of the Colony. Eggs were laid, and the first hatchings occurred early in April. Control measures, which resulted in very little damage being done to crops, included collection of adults, trenching, burning with flame-throwers, spraying with sodium arsenite, and the use of poison baits.

van der Merwe (C. P.). **Pernicious Scale.**—*Bull. Dept. Agric. S. Afr.*, no. 118, 11 pp., 1 pl. Pretoria, 1932.

In South Africa, *Aspidiotus perniciosus*, Comst. (San José scale), a brief description of which is given, occurs over most of Natal, the southern Transvaal and the east and south of the Orange Free State and has recently been recorded in Cape Province. The most important food-plants are peach, apple, pear, plum and other rosaceous plants. *Citrus* is not attacked. This Coccid is not very conspicuous, and trees may be dying before its presence is suspected ; one of the chief indications of infestation is the red discolouration of the bark due to poisoning. Natural distribution can only take place when the insects are young and are able to crawl from tree to tree where the branches touch. At this time they may also be carried on the feet of birds or on the bodies of other insects that visit the trees. Though transport of infested plants is an important means of spread, the author considers that the methods of storing, transportation and utilisation makes risk of dissemination on fruit negligible. Discarded fruit parings dry or decay, and the insects that may be on them perish [*cf. R.A.E.*, A, xx, 256].

Lime-sulphur wash or an oil spray, applied at winter strength when the trees are dormant, will maintain effective control provided that the trees are sprayed regularly every winter. Two sprays may be necessary when infestation is severe, and in areas with winter rainfall treatment should be carried out as late as possible to prevent loss of spray material.

Ghesquière (J.). **Rôle des Ipides dans la destruction des végétaux au Congo belge.**—*Ann. Gembloux*, xxxix, no. 1, pp. 24–37, many refs. Brussels, January 1933.

A general account is given of the feeding habits of the Scolytids of the Belgian Congo and the manner in which they sometimes occur in association with each other and with weevils. They may be divided into two distinct groups comprising the wood eating and seed eating species. The latter are primary pests, whereas the former only attack plants that have already been weakened by other causes. The natural enemies of the African Scolytids are briefly reviewed; the author considers that insect enemies, and still more entomogenous fungi, play an important part in controlling them. A list is given of upwards of 50 species of Scolytids occurring in the Belgian Congo, showing their food-plants and the parts attacked, and another of the plants to show the diversity of species that may attack a given food-plant.

[Vrijdagh (J. M.)] Vrydagh (J. M.). **Le "ver rose" du coton** *Gelechia gossypiella* **Saund. dans les Districts des deux Uele.**—*Bull. agric. Congo belge*, xxiii, no. 1, pp. 54–61, 1 map. Brussels, March 1932. [Recd. January 1933.]

The local distribution of *Platyedra* (*Gelechia*) *gossypiella*, Saund., on cotton in the Welle region on the northern Belgian Congo is discussed, and general information on its biology is given, together with descriptions of the larvae, pupae and adults and an outline of measures for control.

[Vrijdagh (J. M.).] Vrydagh (J. M.). **Les invasions de criquets migrateurs dans la Province Orientale.**—*Bull. agric. Congo belge*, xxiii, no. 2, pp. 147–165, 11 figs., 14 refs. Brussels, June 1932. [Recd. January 1933.]

Prior to 1928, locust invasions of the eastern Belgian Congo occurred approximately between 1890 and 1898, and again in 1917–1918. The species involved cannot be identified definitely, but it appears that the territory was usually first invaded by *Schistocerca gregaria*, Forsk., which was followed by *Locusta migratoria migratorioides*, Rch. & Frm., and then by *Nomadacris septemfasciata*, Serv. *N. septemfasciata* was undoubtedly present on the western shores of Lake Albert in 1917 and 1918.

The invasion that began in 1928 is described in detail and illustrated by sketch-maps. Swarms of *S. gregaria* were observed in the north and north-east of the Eastern Province in 1928 and 1929, and were numerous in January and February 1930, flying generally to the south-east. Some swarms of *L. m. migratorioides* appeared with them in 1930. Another invading wave of the latter species occurred from November 1930 to March 1931, the swarms coming from the north and going south-eastwards. In April and May, these swarms stopped to breed along the northern and north-eastern boundary of the Eastern Province, in the neighbourhood of Lake Albert and to the north of it. Swarms of the next generation migrated partly north-westwards into the Welle-Nepoko district, and partly to the south into the Kivu Province; some swarms travelled westwards over the equatorial forest as far as Stanleyville, where they dispersed. In May 1931,

swarms of *Nomadacris septemfasciata* made their appearance on the Lualaba River, south of Kasongo, and swarms of both species have been present in the south of the Manyema district during November. From December 1931 to March 1932 *L. m. migratorioides* bred in a number of areas in the north and north-east of the Eastern Province, while both species bred in the Ruzizi Valley between Lakes Kivu and Tanganyika and on the Luama River in the Manyema district.

The results of general observations on the bionomics of *L. m. migratorioides* are given. Eggs are usually laid in the plains near lakes and in light soil near rivers, but instances of egg-laying under unfavourable conditions were also observed. In Ituri oviposition occurred in March 1931, a little before the beginning of the rains, and in December eggs were laid during the dry period. Amongst the food-plants, Gramineae are preferred, particularly maize, *Pennisetum* and *Imperata cylindrica*, as well as *Sorghum, Eleusine*, rice, sugar-cane and bamboo. Bananas and palms are sometimes attacked, but ground-nuts are seldom touched, and sweet potatoes, beans and cassava are avoided.

Opsomer (J. E.). **La culture du kapokier à Java avec quelques notes sur sa culture en d'autres régions.**—*Bull. agric. Congo belge*, xxiii, no. 2, pp. 166–204, 9 figs., 5 pp. refs. Brussels, June 1932.

In this continued paper, one chapter (pp. 178–186) is devoted to the fungous diseases and animal pests of the kapok tree, *Eriodendron anfractuosum* (*Ceiba pentandra*), in Java, including 47 species of insects, which are listed under their orders, with notes in many cases on bionomics, most of them being only minor pests. Of the four most important species, the larvae of the Noctuid, *Mudaria variabilis*, Rpke., destroy some of the seeds and fibre in the capsules, and they soil what they have not eaten, making the fibre unfit for use and susceptible to fungous diseases. The adults of the Halticid, *Podagrica* (*Nisotra*) *gemella*, Erichs., are especially injurious in nurseries, where they attack the young leaves, petioles and the growing point of the plants, stopping their development and ultimately causing death. The eggs are laid in small batches in the soil at the base of the plants close to the surface, and the larvae probably feed on the roots. For control in nurseries, dusting or spraying with lead arsenate is recommended. The larvae of the Lamiid, *Batocera hector*, Thoms., bore in the trunks, but may be destroyed by a wire introduced into the galleries, or by injections of 50 per cent. carbolineum. The adults of the Curculionid, *Alcides leeuweni*, Heller, which may have three generations a year, attack the tips of the plants and oviposit in the young shoots, preferably on flower-bearing branches. The larvae hatch in 8–10 days and bore in the pith of the branches, maturing in from 10 weeks to 4 months. The pupal stage occurs in the branches and lasts 8–14 days, and the adults remain in them for 4–7 days. Control is practically impossible in the field, but in the nurseries the affected branches should be cut off and burnt.

Reports received from Experiment Stations, 1931–32.—Med. 8vo, ix+172 pp., ill. London, Empire Cotton Growing Corp., 1933. Price 2*s*. 6*d*.

The various pests of cotton are discussed as in previous years [*R.A.E.*, A, xx, 242, etc.], most of them being of usual occurrence in the countries concerned. Work done at Barberton, South Africa, is summarised by F. S. Parsons (pp. 14–23). The almost total failure of

Trichogramma lutea, Gir., bred from eggs of *Heliothis obsoleta*, F., on maize in September and October, to oviposit in the eggs of *Sitotroga*, *Plodia* and *Ephestia* in the laboratory, whereas others obtained from the same area at about the same period in the previous year had reproduced on them without difficulty, indicates the presence of different strains. Stock for release in the current year was reared on eggs of *Euxoa segetum*, Schiff. Data obtained in the field showed that the eggs of *H. obsoleta* were more often laid on the larger plants of cotton, probably owing to the better shelter they afford during the day; 20·4 and 58 per cent. of the total eggs recorded on cotton in one field were present on 8·3 and 34 per cent. of the plants respectively. They were comparatively evenly distributed on maize. Wind had a considerable effect on the liberation of *T. lutea* against *H. obsoleta*, the percentage of parasitism being increased from 0 to 42 in a field of maize situated some hundreds of yards to leeward of the one in which the liberations were made. Larvae of *H. obsoleta* attacking cotton and other rain-grown crops are thought to be the progeny of adults that have matured during September–November on irrigated crops (chiefly vegetables), and the investigation of the possibility of extensive liberation of *T. lutea* on these crops to reduce the potential population on cotton was considered of value for various reasons, which are summarised. The occurrence of natural parasitism was recorded as the result of a survey in the winter and spring of 1930. Experiments begun in October and November 1932 are still in progress, but weekly liberations on maize of 9,600 individuals per acre for 5 weeks resulted at the end of November in parasitism of 72 per cent., whereas the percentage of natural parasitism in outside areas was still low. Unsuccessful experiments were made on the large scale rearing of a species of *Phanurus*, possibly new, an active parasite of the eggs of *H. obsoleta*. The seasonal occurrence of *H. obsoleta* and the red bollworm [*Diparopsis castanea*, Hmps.] was recorded in various districts. On cotton the larvae of the latter were attacked by *Apanteles diparopsidis*, Lyle, and an unidentified Tachinid, which is also present in the northern Transvaal; 27 and 41 per cent. of the larvae of the first generation of *H. obsoleta* on maize were attacked respectively by a previously unrecorded Dipterous parasite and by the Tachinid, *Sturmia inconspicua*, Mg., and 20–30 per cent. parasitism of the larvae on cotton was effected by the latter in one locality in March.

E. O. Pearson, reporting on the work done on *Dysdercus* spp. at the same station (pp. 21–23), states that a survey of the malvaceous and sterculiaceous flora revealed the presence of a large number of herbaceous plants that were lightly infested and might maintain small numbers throughout the year. The open fruits of extensive colonies of *Sterculia* spp. provide a breeding-place from November to February for 2 or 3 generations, the disappearance of the final population, which is large, coinciding fairly closely with the appearance of the first migrants on plant cotton in March. The first generation developed on cotton was extremely large, a maximum of 20,000 individuals being present to an acre on 9th May, so that late planted and re-planted cotton was severely stained and yielded a high percentage of bad seed. The infestation was completely eradicated by cutting out the bulk of the crop during the latter part of June and early July and stacking it in heaps for a week prior to burning, most of the fields being ploughed shortly after. The species of *Dysdercus* found in this district are *D. nigrofasciatus*, Stål, *D. intermedius*, Dist., which is rare, and *D. fasciatus*, Sign., which is the most important.

The work done at Mazabuka, Northern Rhodesia, from 1930 to 1932, is discussed by A. G. Bebbington and W. Allan (pp. 48–72), the following being largely taken from their summary : Investigations have shown that *Dysdercus* spp. and *H. obsoleta* are the factors limiting the commercial cultivation of cotton in north-western Rhodesia. The occurrence of *D. fasciatus* and *D. superstitiosus*, F., has been found to be closely correlated with humidity, the former predominating when the relative humidity falls below 70 per cent. and the latter when it exceeds this figure. In 1931, dry conditions resulted in an early migration of *D. fasciatus* to the cotton fields. In 1932, despite the relatively longer period of high humidity, infestation by *D. superstitiosus* was not so severe as in the previous year, probably partly owing to the presence of large areas of attractive annual food-plants, which only appear in a wet season. The period between the crops is passed chiefly on *Andansonia digitata* and *Thespesia rogersi*, particularly the latter, and the normal annual food-plants appear to consist mainly of several species of *Hibiscus*, which may be more attractive to the stainers than cotton, and possibly of *Abutilon* and *Sida*. Similar growth to that already recorded [xx, 244] was made by plants on light and dark soils, and though a considerably larger crop was set on the latter type, this was offset by a consistently greater degree of staining. In view of the fact that the removal of a large number of stainers did not reduce the amount of staining below that of the control plots, it is thought probable that soil differences are capable of influencing the degree of injury to a greater extent than can be attained by seed-trapping or hand-picking.

The situation as regards *Earias insulana*, Boisd., and *H.* (*Chloridea*) *obsoleta* is discussed, particularly that of the latter during 1930–31. The postponement of planting to avoid the greater part of the bollworm attack reduced the damage caused, but resulted in the production of a smaller crop. A detailed analysis of the crop set by all plantings showed that 84 per cent. of the total crop was shed as squares and bolls, largely owing to *Dysdercus* and bollworms, and that the final crop picked consisted of only 16 per cent. and the undamaged crop of less than 4 per cent. of the total crop set. Experiments on the value of different varieties and their relation to attack by *D. superstitiosus* and *D. fasciatus* are discussed.

[Nevskiĭ (V.).] **Невский (В.). A brief Guide to the Control of Orchard and Vine Pests in Central Asia.** [*In Russian.*]—Demy 8vo, 138 pp., 1 diagr. Moscow & Tashkent, CAOGIz, 1932. Price *Rub.* 3.

This handbook has been compiled as a technical guide for the staffs of Soviet collective orchards and vineyards in Central Asia and is largely based on the results of investigations carried out for a number of years in Uzbekistan. The importance of the pests and diseases concerned is briefly discussed, and separate chapters deal with those attacking vines and the different orchard trees, each including a list of the insects, mites and fungi under their popular and scientific names, showing the types of injury caused and the months in which it occurs. These lists are followed by notes on the bionomics and control of the more important species and their distribution in Central Asia, with programmes for suitable measures in the different months. Two pages are devoted to mechanical methods of control, and about 60 to

insecticides, information being given on the properties, composition, use and preparation of various sprays, dusts and fumigants. Notes on spraying and dusting machinery and dusting from aeroplanes are included.

[PREDTECHENSKIĬ (S.).] **Предтеченский (С.). The Desert Locust** (*Schistocerca gregaria*, **Forsk.**) **in Persia.** [*In Russian.*]—*Sborn. VIZRa* [*Mag. All-Union Inst. Plant Prot.*], no. 4, pp. 72–76, Leningrad, 1932.

The invasions of *Schistocerca gregaria*, Forsk., originate in sparsely populated countries, and when the locusts arrive in cultivated areas, they are sexually mature and immediately lay eggs, which develop within 3–4 weeks. When invasions occur unexpectedly, there is thus no time to make the necessary preparations for control, the correct organisation of which must be based on exact forecasts of the size of the invasions, and of the threatened areas. The author's investigations in Persia, which were carried out during 1930 and 1931 and covered most of the country, but in particular the eastern provinces, aimed at discovering the conditions that regulate the spring migrations of this locust, from which it would be possible to forecast the invasions of the Russian territories.

Only one annual generation is produced in Persia, the adult stage lasting about 10 months. The winter is passed as an adult in the narrow low-lying strip along the coasts of the Persian Gulf, Ormuz Straits and the Arabian Sea, which is the hottest zone of Persia, having a mean annual temperature of 24–27°C. [75·2–80·6°F.]. The locusts are active throughout the winter and undertake local migrations. Sexual maturation begins in winter, and by February the locusts are mature. At this period, with the advent of warmer weather, a northward migration begins, at first along the warmer plains, spreading gradually to the areas 900–1,250 miles distant from the hibernation area. Since food is essential for migrating locusts, the usual migration routes avoid vast areas devoid of vegetation. Swarms of locusts hibernating in Persia are augmented by others, much more numerous, arriving from the winter quarters in North-west India (through Baluchistan and south-western Afghanistan) and in Arabia (through the Oman peninsula and Eastern Mesopotamia). In Persia itself, there are four main migration routes. One leads from Baluchistan, around the Seistan depression, along the middle course of the Geri-rud River, and into the Karakum plains. The second skirts the Dasht-i-Lut desert, crosses the eastern part of the Dasht-i-Kevir and enters the Karakum plains across the Kopet-Dagh mountains. The third route branches off the second, skirting the Dasht-i-Kevir on its western side, and reaches the Elburs mountains. The fourth route leads along the Karun valley, enters Persian Azerbaijan through the Urmian gate and continues into the Araxes valley. These routes are not all used every year, the course taken depending on the distribution of hibernating swarms within the winter area. The mean rate of advance of migrating swarms is 7½ or 8 miles a day, though it varies according to meteorological conditions.

Though long-range forecasts of invasions into Russian territories could not be made without first studying the locust situation in North-west India and Arabia, it would be possible to organise immediate forecasts during outbreaks. For this purpose, it would be necessary to establish two observation posts on each of the three main migration

routes, the duty of each post being to report on the appearance of swarms and the intensity of the migration. The posts should be placed at such distances that the appearance of swarms in Russian territory could be forecast a month beforehand. Such a forecast was actually made in 1931, and proved to be correct.

[Strel'nikov (I.).] **Стрельников (I.). The Effect of solar Radiation and Wind on the Temperature of the Body and the Behaviour of the Larvae of the Locust** *Locusta migratoria* **L.** [*In Russian.*]—*Sborn. VIZRa* [*Mag. All-Union Inst. Plant Prot.*], no. 4, pp. 76–81, 2 graphs. Leningrad, 1932.

Exact experimental data on the subjects indicated in the title are given. Under the influence of direct insolation the body temperature of hoppers may become as high as 42·7°C. [107·96°F.], when the air temperature is only 28°C. [82·4°F.]. It is subject to great fluctuations caused by wind, by the angle at which the sun's rays strike the insect and by its colour. Thus hoppers of the swarming phase had a temperature up to 5·8°C. [10·44°F.] higher than those of the solitary phase under the same conditions of insolation. The air-sacs are of great importance in the regulation of body temperature, which rises sharply during flight, but is lowered through the ventilation of the air-sacs. The importance of studying microclimatic factors with reference to the behaviour of locusts is stressed.

[Steinberg (D.).] **Штейнберг (Д.). The cyclic Method in the Study of the reproductive System and its Application in the Case of the Meadow Moth.** [*In Russian.*]—*Sborn. VIZRa* [*Mag. All-Union Inst. Plant Prot.*], no. 4, pp. 81–85, 1 graph. Leningrad, 1932.

An account is given of investigations carried out in the summer of 1932 in the Astrakhan Government to determine the causes of the marked fluctuations in the fertility of the meadow moth [*Loxostege sticticalis*, L.], which may range from over 400 eggs per female to the complete sterility of a whole generation.

The author believes that a study of the cycle of the processes that take place in the development of the reproductive system in insect pests is of great importance, since this cycle is a result of physiological changes in the whole organism, and these are dependent on the cyclic succession of environmental factors. A knowledge of the relation between these factors and the life-cycle of the insect would render possible preventive measures of control. As the environment affects the reproductive system through alterations in the process of metabolism, a study of the cycle of the development of the system is only possible by means of a complex of different methods of investigation, of which the morphological and ecological are the most important. Of these, the former comprises a study of the anatomy and cytological structure of the reproductive organs under the action of various environmental factors, and the latter consists of counts of the number of eggs deposited under different conditions of existence.

In the author's work, the results of which are tabulated, a number of females of *L. sticticalis*, of which there were one hibernating and three summer generations, were dissected every day and the oöcysts in the ovaries counted with a view to determining the successive changes that take place in the development of the gonad. It was found that

the females emerge from the pupae with gonads of varying degrees of maturity and that the rapidity of their development depends on the relative humidity of the air. Lack of humidity retards the maturation and causes degeneration of the ovaries, whereas an increase in it checks this degeneration. When there was a sudden fall of temperature in May, the moths emerged with immature ovaries. Moreover, insufficient nourishment in the larval stage resulted in the moths emerging with only rudiments of the gonads ; supplementary feeding of the adults did not visibly accelerate the process of maturation.

On the basis of these investigations, the author believes that the sterility of the meadow moth may be explained by the following two fundamental causes : the protracted successive degeneration of individual oöcysts in the ovaries as a result of insufficient atmospheric humidity ; and the emergence of females with gonads that are already sterile owing to the effect of various factors on the larval and pupal stages, the main factor being insufficient nutrition of the larvae.

Cases of pathological sterility [*cf. R.A.E.*, A, xx, 627] are very rare, and cannot, therefore, be of practical importance in reducing the fertility of the moths. No cysts in the ovaries were ever found by the author.

[Rodionov (Z.).] **Родионов (З.). The Sulphur Problem.** [*In Russian.*]—*Sborn. VIZRa* [*Mag. All-Union Inst. Plant. Prot.*], no. 4, pp. 130–131, 1 portr. Leningrad, 1932.

The use of sulphur dust in the Russian Union for the control of the red spider [*Tetranychus* sp.] on cotton and various plant diseases is in general not economically justifiable, as about 80–90 per cent. of the dust is usually wasted owing to its being carried away by wind, or subsequently covered with earth during the cultivation of the soil between the rows of the plants or in the course of irrigation. The toxic properties of sulphur and the factors responsible for them are briefly discussed, and the results are given of investigations in Moscow of the causes of its action on pests. It was found that under certain conditions sulphur dissolves in water and evaporates with it, reaching the pests as a water solution. In a dusted field this may be explained by the fact that about 10 tons of water may evaporate in 24 hours from one acre. Evidence has been secured that dusting infested cotton before irrigating the field does not affect the red spider, whereas treatment three or four days after irrigation results in 81–100 per cent. mortality in 10–15 days. These facts indicate that sulphur could be successfully used as a spray, which would result in a marked economy of material. As sulphur springs are numerous in the Russian Union, the manufacture of concentrated solutions would be possible. Such sprays could be applied in localities in which the temperature is too low for the carriage of the sulphur in water vapour.

Wille (J.) & Salmón de los Heros (A.). **Control de la mosca de la fruta** (*Anastrepha fraterculus*) **y experimentos de embolsado de frutos en las zonas de Magdalena y de Malambo.** [Control of *A. fraterculus* and Experiments in Covering Fruits with Bags in the Magdalena and Malambo Districts.]—*Bol. Direcc. Agric. Ganad. Peru*, ii, no. 3–5, pp. 140–158, 4 pls., 1 fig. Lima, 1932. [Recd. February 1933.]

In experiments against the fruit-fly, *Anastrepha fraterculus*, Wied., in Peru, in November and December 1931, bait-sprays did not give

effective control, but the fruits of peach and cherimoya [*Anona*] were successfully protected from infestation by enclosing them, singly or several together, in paper bags. The method of making the bags is described.

Wille (J.). **Viaje . . . a Huanaco, para establecer una colonia de** *Novius cardinalis.* [Journey to Huanaco to establish a Colony of *Rodolia cardinalis*.]—*Bol. Direcc. Agric. Ganad. Peru,* ii, no. 3–5, pp. 158–160, 1 pl. Lima, 1932. [Recd. February 1933.]

Rodolia (*Novius*) *cardinalis*, Muls., which was imported into Peru from the United States in September 1932, was liberated at Huanaco on *Citrus* infested with *Icerya purchasi*, Mask., and has apparently become established.

Elgueta (N.). **Un Enemigo de la Escama roja.** [An Enemy of the Red Scale.]—*Rev. chil. Hist. nat.,* xxxvi, p. 85. Santiago de Chile, 1932.

Coccidophilus citricola, Brèthes, is recorded as predacious on *Chrysomphalus aurantii*, Mask., in Chile, the restricted distribution of the scale there being probably due to this Discolomid beetle.

Porter (C. E.). **Nota sobre** *Plagiodera erythroptera,* **Bl.**—*Rev. chil. Hist. nat.,* xxxvi, p. 196. Santiago de Chile, 1932.

All stages of the Chrysomelid, *Plagiodera erythroptera*, Blanch., are recorded as occurring simultaneously in December 1932 on willow in northern Chile.

Stuart (G. Moody). *Lixophaga* **versus Moth Borer. Interesting Experiments in Antigua.**—*W. Ind. Comm. Circ.*, xlviii, no. 894, p. 17. London, 5th January 1933.

Between March and May 1932, seven consignments of *Lixophaga* [*diatraeae*, Towns.] were received in Antigua from Cuba for the control of the sugar-cane moth borer [*Diatraea saccharalis*, F.] [*cf. R.A.E.*, A, xx, 582, etc.]. These were bred in the laboratory, and small colonies were released on various sugar plantations. By the end of November the parasite was found to be established over 5 acres at the rate of 5,000 to the acre on sugar-cane in a field adjoining one of the points of release. It has been estimated that the loss caused in Antigua by *D. saccharalis* may amount to 30 per cent. of the crop, partly arising from the number of young canes killed, partly from reduction in weight of mature canes, and partly from the deterioration of juice extracted in the factory. If the parasite can so control this pest as to reduce this loss to a negligible figure, the resulting increase in the sugar-producing capacity of the Island will abundantly compensate for the expenditure involved in introducing it.

De Leon (D.). **Notes on the Biology of** *Meteorus hypophloei* **Cushm. (Hymenoptera-Braconidae.)**—*Bull. Brooklyn Ent. Soc.*, N.S., xxviii, no. 1, pp. 32–36, 1 pl. Brooklyn, N.Y., February 1933.

In view of the existing uncertainty regarding the hosts of the species of *Meteorus*, most of which parasitise Lepidopterous larvae, various

observations are recorded on the biology of *M. hypophloei*, Cush., which is a primary parasite of the larvae of the Tenebrionid, *Hypophloeus parallelus*, Melsh., and probably other associated species of the genus in north-eastern Washington and south-western Montana [*cf. R.A.E.*, A, xix, 579]. Adults were reared in Washington in May 1930 from cocoons collected from western white pine (*Pinus monticola*) in the latter part of April, during a study of the natural enemies of *Dendroctonus monticolae*, Hopk., but though various hosts were offered, parasitism was not secured until August. Oviposition occurred readily in previously parasitised larvae, but only one individual emerged from a single host in the field. Only moving larvae were attacked, and they did not appear to be affected at any period by as many as 6 punctures. One larva emerging from *H. parallelus* was eaten by that of a second beetle larva before it could pupate. Adults were observed in the field from about the middle of June to 23rd September, being particularly numerous about the middle of July and the beginning of September. The Tenebrionid larvae appeared to be equally abundant beneath the bark of trees in which parasites were present or absent. The adults are very active and crawl over the surface of the bark apparently in search of host larvae. The egg and larva are briefly described.

A female of *M. hypophloei* was reared at the beginning of July 1929 from a cocoon collected towards the end of May under the bark of lodgepole pine [*P. contorta*] in Montana. Adults were also collected in August. It is considered probable that the parasite has one generation a year, hibernating as a larva in the cocoon.

Swenk (M. H.). **Codling Moth Investigations for 1929–1931.**—*Rep. Neb. Hort. Soc.*, 1930, pp. 27–46; *Op. cit.*, 1931, pp. 109–128; *Op. cit.*, 1932, pp. 583–608. Lincoln, Neb., 1930–32.

These reports deal with the continuation in the years 1929–1931 of the investigation of the seasonal history of the codling moth [*Cydia pomonella*, L.] in Nebraska begun in 1928 [*R.A.E.*, A, xviii, 283]. The meteorological conditions are summarised for each year, as related to the activities of the moth and the timing of sprays, and details of the rate of development of each brood are given. The date of hatching of the first larvae of the first brood varied from 28th June in 1928 to 2nd June in 1931, but irrespective of variations in the date of first appearance, hatching of the first brood reached its maximum on 1st July in 1928 and 1929 and on 20th June in 1930 and 1931, when protracted hatching was probably responsible for too early application of the first cover spray. For the first time in the four seasons the third brood of larvae would have been large enough in 1931 to justify a cover spray early in September, apart from the consideration of spray residues.

Herms (W. B.). **Deterrent Effect of artificial Light on the Codling Moth.**—*Hilgardia*, vii, no. 7, pp. 263–280, 4 figs., 3 refs. Berkeley, Calif., December 1932.

Further data on the reactions of *Cydia* (*Carpocapsa*) *pomonella*, L., to artificial light were obtained from an experiment carried out in California during 1929 in continuation of a previous one [*R.A.E.*, A, xvii, 370]. The conditions of the experiment were similar, except that the number of lamps was increased to 18, and the period of illumination extended throughout the entire season, from 24th April to 24th October.

All apples, including thinnings and windfalls, were examined. Infestation in those from unsprayed, wholly illuminated trees amounted to 49·7 per cent., as against 71·3 per cent. in those from the unsprayed, non-illuminated check plot and 7·4 per cent. from the non-illuminated sprayed trees. In spite of the fact that a higher artificial light intensity was used than in the previous experiments, the relative reduction in infestation only amounted to 30 per cent., as compared with 31 per cent. in 1928. In the case of a single variety of apple, the apparent reduction was more than 50 per cent. (illuminated 44·1 per cent.; non-illuminated 89·1).

Since *C. pomonella* deposits eggs rather freely within a light intensity range of 0·3–90·0 foot-candles, with maximum activity occurring at one of 25–52 [xx, 132], and in view of the fact that an artificial light intensity of 11–112 was maintained, the intensity of artificial light was not sufficiently high wholly to prevent the moths from entering the illuminated area and depositing eggs, although there was a substantial decrease in the attack. By means of a graph in which infestation is plotted against the reciprocal of the square of the distance from the centre of the lighted area ($1/D^2$), the range of artificial light intensity over which infestation remains fairly constant is shown to be 30×10^{-5} to $1,560 \times 10^{-5}$, when measured in values of $1/D^2$, and it is not until the function of $1/D^2$ falls below 30×10^{-5} that infestation increases abruptly.

The real value of light in combating *C. pomonella* could only be ascertained if an entire large area were to be illuminated. It is quite probable that moths prevented from entering an area under effective illumination might go elsewhere to more attractive, darker areas to deposit their eggs, whereas it is unlikely that moths that succeeded in entering the lighted area in spite of the repellent effects of the light would be deterred from oviposition. The reported reduction in infestation is believed to be due to the fact that there were fewer moths in the illuminated area.

Entomology and Parasitology.—*Rep. California Agric. Expt. Sta. 1930–31*, pp. 67–72. Berkeley, Calif., 1932.

During the year ending June 1931, the use of bait traps in timing sprays against the codling moth [*Cydia pomonella*, L.] in California again proved of value [*cf. R.A.E.*, A, xx, 219, 583], a heavy loss due to a large emergence of the moth in September 1930 being averted in the coastal counties where they were employed, whereas in other districts losses of 35–70 per cent. of the late apples occurred. Field experiments in its control on apples and pears showed a spray of summer oil and lead arsenate to be most effective; in one district it reduced the percentage of infested fruit at picking time to 5·5, as compared with 40–50 on the untreated trees. On apples, summer oil alone gave better control than lead arsenate alone, whereas the reverse was observed on pears. Reference is made to the results of field investigations in 1929 on the effect of artificial light on the infestation of apples by *C. pomonella* [see preceding paper]. *Empoasca fabae*, Harr. (*mali*, LeB.), which injures the foliage of apple, was found to be increasing in importance in two districts. The excreta it deposits necessitate washing the fruit. Nymphs were successfully controlled by sprays containing nicotine sulphate. Brief notes are given on the control of *Erythroneura comes*, Say (grape leafhopper), chiefly by means of calcium cyanide dust [see next paper] A dust of 55 lb.

hydrated lime, 30 lb. sulphur, 10 lb. 40 per cent. nicotine sulphate and 5 lb. dry lime-sulphur or 1 lb. powdered lye gave 88·91 per cent. control of the nymphs. *Tetranychus pacificus*, McGregor, was observed hibernating in large numbers under the bark of grape-vines near the crowns. In early March the mites migrated to various weeds for oviposition.

Investigations on the control of *Scutigerella immaculata*, Newp. (garden centipede) were continued [xx, 356]; in laboratory tests with poison baits, sodium arsenite, mixed at the rate of 2·5 or 5 per cent. with red beets or carrots cut in cubes, killed 75 per cent. in two hours; in several cases 100 per cent. mortality was obtained in ten days, whereas calcium and sodium fluosilicates and sodium fluoride proved practically ineffective. In experiments against *Hercothrips fasciatus*, Perg., on pears, it was found that though neither oil alone nor oil and nicotine gave a satisfactory kill, these sprays were very effective in preventing defoliation. Tests of ovicides against *Hyalopterus arundinis* (mealy plum aphis) showed that in the case of the paste-type oil emulsions there was no correlation between toxicity and viscosity or unsulphonated residue; the percentage of eggs killed increased with an increase in oil in the final spray mixture. The addition of dinitro-ortho-cresol to oil sprays greatly increased their toxicity. In field experiments, spraying at the time of the opening of the first flowers was much more effective than in the autumn; the best results were obtained by spraying in autumn and spring with a combination of oil and nicotine.

Owing to mild weather during the autumn and early winter, *Listroderes obliquus*, Gyll. (vegetable weevil), which became active in early October, caused more damage than usual, but in many instances was successfully controlled by dusting with barium or sodium fluosilicate [*cf*, xxi, 168].

Lockwood (S.). **The Grape Leafhopper in California, with special Reference to its Control.**—*Mon. Bull. Dept. Agric. Calif.*, xxi, no. 10–11, pp. 375–393, 9 figs., 18 refs. Sacramento, Calif., 1932.

This account of *Erythroneura comes*, Say (grape leafhopper) is based partly on the studies of other workers and partly on the author's observations in California. Its history, economic importance and distribution are discussed. The adults hibernate among weeds, grasses and crops close to vineyards, as well as in rubbish in the vineyards themselves. In 1932 practically all the leafhoppers had moved into the vineyards by 15th April, and oviposition had begun, though it did not reach its maximum until May. The sexes are about equally represented, and the females lay about 100 eggs, some continuing to oviposit for over a month. Young nymphs were found about the middle of May and hatching continued until the end of June in the southern half of the San Joaquin valley. In the northern half the dates were 10–14 days later. The life-cycle from egg to adult as observed in the field lasts 30–40 days for the spring generation, and the second brood seems to develop much faster. The young nymphs observed on the vines in late September and October probably represent a third brood. During the summer the leafhoppers feed on the foliage of vines and closely related plants such as Virginia creeper (*Parthenocissus quinquefolia*), but during the warm days of autumn, winter and spring the adults have been observed attacking a variety of plants such as lucerne,

clovers, mallow (*Malva parviflora*), and filaree (*Erodium cicutarium*). Barley, rye and other cereals are winter food-plants, as are also beans, ragweed (*Ambrosia psilostachya*), docks (*Rumex* spp.), mustard (*Brassica campestris*) and wild horehound (*Marrubium vulgare*). Strawberry foliage is a preferred food-plant in early spring. Some of these plants have been used as trap crops on which to kill overwintering adults before the vines start growth.

The question of control is discussed in detail [*cf. R.A.E.*, A, xiii, 52 ; xv, 431 ; xviii, 711]. During the late summer and early autumn of 1931, 20–95 per cent. of the eggs of *E. comes* were attacked by the Mymarid, *Anagrus epos*, Gir., and it is believed that this parasite may be responsible for the fact that only two full broods of the leaf-hopper mature in a year. A spray of nicotine sulphate and whale oil soap applied to grapes in May 1931 resulted in the fruit becoming scarred, although in past seasons the use of this type of soap had resulted in little or no commercial damage. Further tests, however, indicated that it is somewhat hazardous to use a spray containing soap after the grapes are formed.

Recommendations for control, based on the fact that early measures are more effective and generally cost less, include ploughing the vineyard and quick burning of the surrounding ditch banks, etc., to destroy overwintering adults ; planting trap strips of alternative food-plants on which the leafhoppers may be killed before the leaf growth of vines starts in the spring ; the use of a vaporised spray of pyrethrum in oil at the rate of 2 U.S. gals. to the acre when most of the adults have collected in the vineyards but before many eggs have been deposited ; and the use of nicotine dust or calcium cyanide, after the spring hatch has occurred, at the rate of 20 lb. of either material per acre for open dusting or 15 lb. for dusting under tents or covers. A spray of 1 lb. 40 per cent. nicotine sulphate and 4–4–50 Bordeaux mixture with water to make 100 U.S. gals. is advocated if spray machines are available, but it should not be applied after the grapes have attained any size.

KLYVER (F. D.). **First Interception of Acacia Psyllid in San Francisco.** *Mon. Bull. Dept. Agric. Calif.*, xxi, no. 10–11, pp. 428–429. Sacramento, Calif., 1932.

Arytaina (*Psyllia*) *acaciae-baileyanae*, Frogg., was intercepted for the first time in California on 12th October 1932 on *Acacia baileyana*, an ornamental plant imported from New South Wales. Many eggs were attached to a twig and leaves of the food-plant, and living nymphs and adults were also present. In view of the potential importance of the Psyllids of *Acacia* and *Eucalyptus* in California, where both are free from conspicuous pests, their effect on these trees in their native country and in other parts of the world where they have apparently become established is briefly discussed.

BRIERLEY (P.). **Virus Disease of Dahlia.** (**Abstract.**)—*Phytopathology*, xxiii, no. 1, p. 6. Lancaster, Pa., January 1933.

The virus of mosaic of dahlia, a disease prevalent in New York, New Jersey and Connecticut, and probably throughout the United States, has been transmitted by grafting and by the Aphid, *Myzus persicae*, Sulz., but not by mechanical methods nor through the seed.

Ehrlich (J.). *Nectria coccinea* **on Beech.** **(Abstract.)**—*Phytopathology*, xxiii, no. 1, p. 10. Lancaster, Pa., January 1933.

A disease caused by *Nectria coccinea* following attack by *Cryptococcus fagi*, Bär., is recorded as causing widespread destruction of beech (*Fagus grandifolia*) in the Maritime Provinces of Canada, the fungus entering the punctures made by the Coccid. Both fungus and insect are disseminated by wind, the latter during the egg and larval stages in summer and autumn.

Hurt (R. H.). **Zinc Hydroxide, a Substitute for Calcium Hydroxide in Arsenical Sprays.** **(Abstract.)**—*Phytopathology*, xxiii, no. 1, p. 17. Lancaster, Pa., January 1933.

For operations on a small scale, zinc hydroxide appears to be a promising substitute for calcium hydroxide when used at the same rate for preventing injury to the foliage of peach and beans by arsenical sprays or dusts. For the prevention of arsenical injury in large commercial spraying operations, it will no doubt be more economical to use the combination of zinc sulphate and lime now in general use in Virginia as a peach spray [*R.A.E.*, A, xx, 322]. Zinc hydroxide causes russeting of certain varieties of apples, but this injury does not seem to occur when it is used in combination with sulphur. It may be prepared in powdered form and then used or stored in the same way as calcium hydroxide.

Ivanoff (S. S.). **Bacterial Wilt of Corn.** **(Abstract.)**—*Phytopathology*, xxiii, no. 1, p. 18. Lancaster, Pa., January 1933.

The larva of *Diabrotica longicornis*, Say, is recorded as an underground vector of *Aplanobacter stewarti*, which causes wilt disease of maize. Larvae that had fed on the roots of diseased plants repeatedly transmitted the disease when placed on the roots of healthy ones in the greenhouse.

Johnson (H. W.). **Nature of Injury caused by Potato Leaf Hopper on Forage Legumes.** **(Abstract.)**—*Phytopathology*, xxiii, no. 1, p. 19. Lancaster, Pa., January 1933.

Artificial inoculation with juice from yellowed and reddened leaves and from adults and nymphs of *Empoasca fabae*, Harr., failed to produce symptoms of injury, nor did symptoms develop on plants started as cuttings from yellowed and reddened plants. Confining single adults upon restricted areas of the leaf petioles of clover for 8, 16 and 24 hours resulted in the reddening and yellowing of about 20, 60 and 50 per cent. of the leaves respectively. With the 24-hour feeding exposure an additional 40 per cent. wilted rapidly and turned brown.

The reddening and yellowing caused by *E. fabae* are not the result of a specific inciting agent, virus or toxin, but are caused by an over accumulation of the carbohydrate products of photosynthesis, especially the osmotically active reducing sugars.

Zaumeyer (W. J.). **Transmissibility of certain Legume-Mosaic Viruses to Bean.** **(Abstract.)**—*Phytopathology*, xxiii, no. 1, p. 39. Lancaster, Pa., January 1933.

It is possible that some of the secondary spread of bean mosaic in the field is the result of Aphid transmission of the virus of mosaic of

Melilotus alba. The virus of mosaic of peas (*Pisum sativum*) and of *Lathyrus odoratus* gave positive results when inoculated into beans, either by means of expressed juices from diseased plants or by *Macrosiphum* (*Illinoia*) *pisi*, Kalt.

Zaumeyer (W. J.). **Transmission of Bean-Mosaic Virus by Insects. (Abstract.)**—*Phytopathology*, xxiii, no. 1, p. 40. Lancaster, Pa., January 1933.

Under controlled greenhouse conditions, in addition to *Macrosiphum gei*, Koch (*Illinoia solanifolii*, Ashm.), *Aphis rumicis*, L., and *Myzus persicae*, Sulz., the known vectors of bean mosaic, *Macrosiphum* (*I.*) *pisi*, Kalt., *A. gossypii*, Glov., *Brevicoryne brassicae*, L., *Hyalopterus atriplicis*, L., and *Macrosiphum ambrosiae*, Thos., also transmitted the virus. All, except the last, have been found on beans in the field, where they are most numerous at the beginning of the growing season.

Lovell (O. H.). **The Vegetable Weevil,** *Listroderes obliquus*.—*Bull. Calif. Agric. Expt. Sta.*, no. 546, 19 pp., 1 pl., 5 figs. Berkeley, Calif., December 1932.

An account is given of the bionomics and control of the Curculionid, *Listroderes obliquus*, Gyll. (vegetable weevil) in California [*cf. R.A.E.*, A, xvi, 257 ; xvii, 35]. No males have yet been found, and reproduction is parthenogenetic [xiv, 153] so that a single individual is capable of establishing the species in any new area where climatic conditions are favourable.

Sodium fluosilicate dust is effective in controlling both adults and larvae on carrots, turnips, spinach and tomatos, with only slight injury to the plants even when they are wet, but it causes severe scorching of potato foliage. Barium fluosilicate can be used with safety even on potato, but it is more expensive and slower in action. Both materials are mixed with 20–30 per cent. diatomaceous earth and applied at the rate of 30–40 lb. dust per acre when the foliage is dense and 15–25 lb. when it is sparse. One application is usually sufficient. Young potato and tomato plants may be treated individually, using enough dust to cover the foliage and the ground at the base of the plant, and in this case 10–12 lb. dust per acre is sufficient.

Since the adults of *L. obliquus* aestivate in weeds, grass and débris near the infested areas, these should be removed completely in May. Unsuccessful attempts to fumigate the soil against the larvae and pupae were made with paradichlorobenzene and carbon bisulphide emulsion. In the case of the latter, with which several tests were carried out, it seems probable either that an insufficient concentration of the gas was obtained owing to its slow evolution at winter temperatures or that, being heavy, it sank below the level of the pupae in the soil. The adult weevils have never been observed to fly in California, and negative results were obtained in experiments with lights and a number of chemicals as attractive agents.

Severin (H. H. P.). **Transmission of Carrot, Parsley, and Parsnip Yellows by** *Cicadula divisa*.—*Hilgardia*, vii, no. 3, pp. 163–179, 7 figs., 9 refs. Berkeley, Calif., November 1932.

The following is taken from the author's summary : The virus of yellows disease was transmitted by previously non-infective individuals

of *Cicadula divisa*, Uhl., from naturally and experimentally infected varieties of carrots, parsley and parsnip to healthy asters and celery, and was also carried from these plants back to the first three and from carrot to carrot, parsley to parsley, carrot to parsley and parsley to carrot, thus proving that the disease of all the plants is caused by one virus in California. The incubation period lasted a minimum of 15 days (in carrots) and a maximum of 106 days (in parsley), the time required in the various plants being given. It is thought that large carrots are more resistant to the disease than young ones. The life-cycle of *C. divisa* was completed on parsnips, on carrots, with the exception of one variety, and on parsley, except the curled variety.

SMITH (H. D.). *Phaeogenes nigridens*, **Wesmael, an important Ichneumonid Parasite of the Pupa of the European Corn Borer.**—*Tech. Bull. U.S. Dept. Agric.*, no. 331, 45 pp., 10 figs., 33 refs. Washington, D.C., November 1932.

An account is given of investigations carried out from 1922 to 1930 on the Ichneumonid, *Phaeogenes nigridens*, Wesm., which is a major parasite of the pupae of *Pyrausta nubilalis*, Hb., in maize, *Artemisia* and hemp in Europe, occurring in Sweden, Germany, Belgium, France, Italy and Hungary. Its economic importance and biology are discussed, with notes on the collection and shipment of consignments to the United States, and descriptions are given of all stages (the adults of both sexes by R. A. Cushman), female reproductive organs and internal anatomy of the primary and last-instar larvae.

The following is largely taken from the author's summary: In the laboratory the adults feed on honey, raisins, sugar (dry or in weak solution) and occasionally on the blood of the host. Usually only one egg is laid in a host, the freshly formed pupae being preferred. Reproduction may readily take place parthenogenetically, in which case the offspring are always males. The egg and larva float freely within the body of the host, being unaffected by its phagocytes, and the larva feeds primarily on the blood and fat and later on the vital organs. Pupation occurs within the host pupa. The life-cycle from egg to adult occupies about 15 days at 77°F. The adults live for long periods, some females having been kept at low temperatures for about 10 months. The winter is passed as an adult female, the males dying prior to or during this period.

The seasonal history of *Phaeogenes nigridens* corresponds closely with that of its host in Europe; the data obtained on this subject in various regions are summarised. In areas where *P. nubilalis* has one generation a year the parasite emerges in the spring, 3 or 4 weeks after the deposition of the egg by the overwintered female; the females of the new generation either hibernate or attack pupae of some other host during the summer. In those where it has two, these latter females oviposit in *P. nubilalis* in July and August, the females of their progeny hibernating. The latter may also produce additional generations on an intermediate host, since females ready to oviposit have been observed in the field at all times. The only known alternative host is *Tortrix pronubana*, Hb., from which a single individual has been reared in the south of France. *Phaeogenes nigridens* is most effective in one region in the north of Italy, where the climatic conditions approach most closely those of the area infested by the borer in New England, the percentage of parasitism being higher than that of any other parasite during 1924–1927 and in 1930, with a maximum of 17·5. Its

effectiveness, however, is limited by various factors, such as the small number of eggs laid by each female, 50 probably being the maximum, the mortality of some eggs in the ovaries of the females, particularly those overwintering, the rather long oögenetic period (1–2 weeks at 77°F.), and the generally unsuitable conditions for oviposition in the spring, resulting from the practice common in Italy of storing the maize stalks in sheds.

Consignments of the parasite have been shipped to the United States at temperatures of 39·2–50°F. annually since 1924, first as adults and subsequently as pupae within those of the host. The emergence after arrival averaged 38·5 per cent.

PETHERBRIDGE (F. R.) & THOMAS (I.). **The Control of the Raspberry Beetle.**—*J. Minist. Agric.*, xxxix, no. 11, pp. 1017–1028, 2 graphs. London, February 1933.

Experiments on the control of *Byturus tomentosus*, F., the bionomics of which are briefly described, were carried out in eastern England in 1931 and 1932 on the same lines as those of Steer [*R.A.E.*, A, xix, 638; xx, 331]. The details of the methods employed are given and the results, which were estimated on the percentage of damaged berries, are tabulated.

In 1931, tests were made on raspberries with a proprietary wash of derris and soft soap at the rate of 1 lb. in 60 gals. water and two proprietary washes of pyrethrum at strengths reputed to be equal to 1 per cent. of dried flowers (at the rate of 300–460 gals. per acre). With the one-solution pyrethrum wash results were poor, but with three applications of the derris and two-solution pyrethrum washes only 11·7 and 9·4 per cent. of the berries were damaged respectively, the sprays being applied at the time the eggs were abundant, when they began to hatch, and again four days later. Untreated plots showed an average of 89·8 per cent. damaged berries, and 70·3 per cent. were damaged on a plot on which fowls were kept from the beginning of April onwards.

In 1932, the pyrethrum wash was discarded on account of its high cost. The damage on raspberries sprayed with 10 oz. nicotine sulphate and 5 lb. soft soap (or a proprietary spreader) in 40 gals. water was 4·6 per cent. as compared with 84·8 per cent. on unsprayed plants. Two sprays were applied, the first when the larvae began to hatch and the second nine days later. Experiments were also carried out on both loganberries and raspberries with lead arsenate (2 lb. to 100 gals. water) and derris (2 lb. in 100 gals. water with 10 lb. of soft soap). When one lead arsenate spray was applied at full bloom, the damage was only 44·6 per cent. on raspberries and 48·6 on loganberries, but a deposit of the arsenate was left on the fruit. The unsprayed plants showed 89·0 and 91·4 per cent. damage respectively. Two sprays of derris and soft soap, the first when large numbers of eggs and few larvae were present and the second 10 days later, reduced the damage to 11·5 per cent. on raspberries and 13·3 on loganberries, and four sprays, the first at the same time as the previous experiment and the others 3, 10 and 13 days later, reduced it to 5·8 and 11·3 per cent.

The most effective control was obtained with a proprietary derris dust (0·2 per cent. rotenone) applied on loganberries early in June to kill the beetles before oviposition. With one dusting, 7·4 per cent. of the berries were damaged and with two dustings 4·5 per cent. These results were compared with the derris and soft-soap spray applied

against the larvae, after two applications of which 13·0 per cent. of the berries were damaged. When two applications of dust were followed by two of spray, 3·2 per cent. were damaged, compared with 69·1 per cent. on untreated plants. It is suggested that in the field, derris dust should first be applied to coat the tips of the shoots before the flowers open, when the beetles are feeding on the leaves, using about 1 cwt. of dust per acre (two applications may be advisable at this time). A further application should be made when the flowers are open, the whole plant being thoroughly dusted, which may require 3 cwt. or more of dust per acre. The dust is best applied in warm sunny weather. This dust was not tested on raspberries but observations on a plantation where it had been used indicate that it will give satisfactory control on these plants.

Wilson (G. F.). **Pollination in Orchards (VIII). Insect Visitors to Fruit Blossom.**—*J. R. Hort. Soc.*, lviii, pt. 1, pp. 125–138, 15 refs. London, February 1933.

This further report [*cf. R.A.E.*, A, xviii, 134] of a study of the insects concerned in the pollination of fruit, which has been carried out at Wisley, Surrey, since 1920, includes a complete list of all the species observed during 1920–1930, showing the flowers they visit.

Peace (T. R.). **The Dutch Elm Disease.**—*Forestry*, vi, no. 2, pp. 125–142, 1 map, 26 refs. London, December 1932.

In England, Dutch elm disease is most prevalent in the south-eastern and midland counties, and in the former it has done considerable damage in certain localities. Towards the north and west it becomes rapidly less common and it has not yet been recorded in the northern counties of Scotland. Figures are given to illustrate its spread in recent years and the marked diminution in its severity in 1932. The symptoms of the disease and the fungus, *Graphium ulmi*, that causes it are briefly discussed. It is believed to be spread chiefly by *Scolytus scolytus*, F. (*destructor*, Ol.) (large elm bark-beetle) [*R.A.E.*, A, xviii, 177 ; xix, 499 ; xx, 121], in the breeding galleries of which fructifications of the fungus occur, and probably also by *S. multistriatus*, Marsh. (small elm bark-beetle), which is less common. Several instances in different parts of the country have been observed by the author in which infection had not spread beyond a localised area (a twig or small branch), and in each of these one or more summer feeding channels of *S. scolytus* were found, the inner surface of which touched the ring of spots in the wood. On none of the twigs could any other obvious means of entry for the fungus be seen. The distribution of this beetle in Britain is not known with certainty, but it is common over the whole area in which the disease is found ; both it and *S. multistriatus* are said to become rarer north of a line joining the Mersey and the Humber, and to be altogether absent in Scotland.

The possibility of infection taking place by other means is discussed. Recent experiments [xx, 340] have shown that the spores of *G. ulmi* can resist two months' desiccation and so might possibly be conveyed to healthy trees by wind ; but since wounds or punctures are required for successful inoculation and the spores are produced in such positions that they can seldom reach the open in large quantities, it seems unlikely that this method of spread can be of great importance.

All the species of elm commonly grown in Britain are susceptible to the disease, and it is impossible to eradicate it by felling, though trees that are past hope of recovery should be felled and barked to prevent *S. scolytus* from breeding in them. An elm may be considered beyond hope either when more than 75 per cent. of the crown is dead, or when beetle attack has begun in the trunk. Trees less severely attacked should have the dead wood removed.

OLDHAM (J. N.). **Helminths in the biological Control of Insect Pests.**—*Notes Memor. Imp. Bur. Agric. Parasit.*, no. 9, 6 pp., 14 refs. St. Albans, 1933. Price 1*s*.

A general account is given of the part played in the biological control of insects by helminths, the importance of which is thought to have been overlooked by the majority of entomologists. Where insects act as intermediate hosts in the life-cycles of heteroxenous forms, they seldom suffer death as the result of the association, but in the case of the monoxenous forms, the mutual adaptation between parasite and host is much less complete, and slight or severe injury, or even death, of the insect results. Primary parasitism in insects usually inhibits normal development, reduces fecundity, or kills the host. In many instances, complete sterility has been recorded. Examples are quoted from the literature to indicate a few of the more important relationships existing between parasitic worms and insect pests.

VAN POETEREN (N.). **Visschen en carbolineum.** [Fish and Carbolineum.]—*Tijdschr. PlZiekt.*, xxxix, no. 1, pp. 14–15. Wageningen, January 1933.

Speyer has recorded in Germany the poisoning of pike by a tar-distillate insecticide [*R.A.E.*, A, xv, 514]. A similar case has occurred in Holland, fish of several species being killed in water near sprayed trees.

ROEPKE (W. K. J.). **Kort verslag over het iepenziekte-onderzoek, verricht op het laboratorium voor entomologie te Wageningen, gedurende het jaar 1932.** [A short Report on the Dutch Elm Disease Investigation in 1932 at the Laboratory for Entomology, Wageningen.]—*Tijdschr. PlZiekt.*, xxxix, no. 1, pp. 16–17. Wageningen, January 1933.

The Braconid, *Coeloides scolyticida*, Wesm., a parasite of the species of *Scolytus* associated with Dutch elm disease in Holland [*R.A.E.*, A, xix, 499], was liberated in 2 localities during the summer of 1932, and in December was found to have established itself. Further observation is necessary to determine its practical value. In the province of Zeeland, *Hylesinus* (*Pteleobius*) *vittatus*, F., was abundant on elms, and this Scolytid is being studied.

PUSSARD (R.). **Contribution à l'étude de la nutrition des Psyllides (Hem.). Présence de gaines dans les tissus de la plante hôte et son importance.**—*Bull. Soc. ent. Fr.*, xxxvii (1932), no. 20, pp. 292–297, 2 figs., 18 refs. Paris, 1933.

Studies to determine whether the feeding of Psyllids causes the formation of stylet sheaths similar to those observed by other authors in the case of Aphids [*R.A.E.*, A, xi, 250, etc.], Aleurodids and Coccids were

carried out with the adults of *Arytaina genistae*, Latr., and *Trioza alacris*, Flor, the larvae of *Psyllopsis fraxini*, L., and the larvae and adults of *Psylla pyrisuga*, Först., and *Rhinocola aceris*, L. Slides were made from sections of vegetable tissue that had been attacked by the Psyllids, coloured with safranin and haematoxylin. In every case the feeding of both larvae and adults produced sheaths, which readily absorbed the colour of the safranin. Among the species studied, the sheath was found to be rarely intercellular, but commonly intracellular, with more or less pronounced swellings in contact with the protoplasm of the cells. Where shoots were concerned, the stylets and their sheath reached and often passed beyond the cambium, penetrating the woody cells or ligneous parenchyma and even, in the case of the larvae of *P. pyrisuga*, reaching as far as the medullary region. A study of these sheaths provides evidence concerning the nutritive elements absorbed by the Psyllids, facilitates the determination of their food-plants, and in the case of certain species, indicates the intermediate food-plants. Definite proof is now available that *R. aceris*, hitherto believed to be a species confined to one food-plant, actually migrates. Adults of this species were observed in the Rhône valley to leave the primary food-plant, *Acer platanoides*, and were found from June to September on *Taxus baccata*, where mating occurred, and on which typical sheaths were produced by feeding.

Pussard (R.). **Observation sur l'acclimatation d'*Aphelinus mali* Hald. (Hym. Chalcid.) à Saint-Genis-Laval.**—*Bull. Soc. linn. Lyon*, (2) ii, no. 1, p. 12. Lyons, January 1933.

In 1931 the author introduced *Aphelinus mali*, Hald., from apple infested with *Eriosoma lanigerum*, Hausm., in the Lyons district into other infested orchards in the neighbourhood. In one of these, the parasite was found to be well established in June 1932.

Delage (B.). **Travaux récents sur les insecticides et anticryptogamiques. Revue de phytopharmacie.**—*Ann. agron.*, N.S., i, no. 3, pp. 366–385, 20 refs. Paris, 1931. [Recd. February 1933.]

The materials dealt with in this review from the literature of recent work on insecticides and fungicides include pyrethrum, the fluorides and fluosilicates, and petroleum oil. The history of the development of pyrethrum is given as typical of the immense possibilities that may lie dormant in an insecticide known for years without its agricultural value having been discovered, and that of the fluorides and fluosilicates as a type of well-known chemical by-products of important industries which have remained long unexploited outside the realm of insecticides. In the case of petroleum oils the barrier between insecticide and fungicide has been broken down so that one and the same material may now be applied against plant diseases and insect pests simultaneously. An outline is given of the mode of action of the substances under consideration, a knowledge of which is indispensable if they are to be used intelligently. The author believes that many insecticides await discovery among the known chemical compounds and that an even wider field for research is offered by organic than by inorganic chemistry.

Schneider-Orelli (O.). **Weitere Versuche mit Frostspannerpuppen** *Operophthera brumata* **L.** [Further Experiments with Pupae of the Winter Moth, *Cheimatobia brumata,* L.]—*Mitt. schweiz. ent. Ges.*, xv, no. 7, pp. 266–268. Berne, 1932. [Recd. February 1933.]

Further observations on *Cheimatobia* (*Operophthera*) *brumata*, L., in Switzerland are described, confirming the view that the pupal period is shorter in material obtained from high altitudes than in that from lower ones [*R.A.E.*, A, v, 270], so that the existence of two races is suggested.

Schneider-Orelli (O.). **Ueber die Bekämpfung holzzerstörender Käferlarven** (*Lyctus*). [On the Control of Wood-destroying Beetle Larvae.]—*Mitt. schweiz. ent. Ges.*, xv, no. 9, pp. 333–334. Berne, 1932. [Recd. February 1933.]

Samples from a timber yard at Zürich where sawn oak logs were found to be infested by borers in the autumn of 1931 yielded 136 adults of *Lyctus linearis*, Goeze, 5 of *Bostrychus* (*Apate*) *capucinus*, L., 11 of *Phymatodes testaceus*, L., and 195 parasitic Hymenoptera. The inner bark and outer cambium layer were removed from the boards in the yard, and the edges thus uncovered were painted with kerosene in November and again in December or with Xylamon Hell (a chlorinated hydrocarbon), in November only. The boards were stacked in the open and examined in May 1932. Those treated with Xylamon showed no new injury and on cutting them open 97 per cent. of the larvae were found dead and the remainder appeared to be affected by the insecticide. On the other hand the timber treated with kerosene had new bore-holes and not more than 10 per cent. of the larvae were dead.

Suter (P.). **Untersuchungen über Körperbau, Entwicklungsgang und Rassendifferenzierung der Kommaschildlaus,** *Lepidosaphes ulmi*, **L.** [Investigations on the Structure, Development, and racial Differentiation of *L. ulmi*.]—*Mitt. schweiz. ent. Ges.*, xv, no. 9, pp. 347–420, 66 figs., 1 graph, 52 refs. Berne, 1932. [Recd. February 1933.]

The greater part of this paper deals with the classification, synonymy, morphology, and anatomy of *Lepidosaphes ulmi*, L. In the Swiss lowlands in 1930 and 1931 the larvae began to hatch at the end of May. They either settled in a few hours, or, if the food-plant was unsuitable, wandered until death by starvation or exhaustion. The rate of travel was 0·2–0·3 in. per minute, and the maximum migration time was 63 hours. The females matured and began to oviposit after about 7 weeks, the oviposition period lasting 10–12 weeks, during which about 40 eggs were laid. The duration of the egg stage was reduced from the normal 9 months to 3 by keeping the eggs indoors at 15–22°C. [59–71·6°F.], the larvae hatching in October.

Examples of *L. ulmi* from apple and pear developed successfully on lilac, rose (*Rosa rugosa*), elm (*Ulmus campestris*) and *Cornus mas*, but not on box [*Buxus*] or broom (*Sarothamnus*), whereas examples from box developed on *Sarothamnus* and *Rosa rugosa*, but not on apple, pear, or *Cornus*. Reproduction was always parthenogenetic on apple and always sexual on box, and the author considers that two races are involved. The females on fruit trees were never fertilised by the males

of the sexual race. Apple was their principal food-plant. Males were always found in the colonies on box, and though unfertilised females of this sexual race form scales, they die without ovipositing. Notes are given on the five races of *L. ulmi*, *viz.*, the parthenogenetic American races of apple and lilac respectively [*R.A.E.*, A, xiii, 569], the European fruit-tree and box races, and the southern (Mediterranean) sexual race. Other races probably occur.

Moderate infestation by this Coccid causes little harm to the plant. Mass-increases occurred with the box race irrespective of the situation in which the trees were growing, but the fruit-tree race flourished principally in protected situations and on weak trees. Recommendations for control include cultural measures helping the growth of the plant and spraying in June and July with oil emulsion, experiments with which are described. Various natural enemies are recorded from the literature; *Aphelinus mytilaspidis*, LeB., and *Cheiloneurus diaspidinarum*, How., were predominant in the author's observations.

MALENOTTI (E.). **Una varietà di melo resistente alla tignola.** [A Variety of Apple resistant to *Hyponomeuta padellus*.]—*Atti Accad. Agric. Sci. Lett. Verona*, (5) xi, reprint 6 pp., 3 pls. Verona, 1933.

In Verona the Cavazzese apple, a variety of *Pyrus prunifolia*, escapes injury by *Hyponomeuta padellus*, L. On 8th May this variety had not yet blossomed, but the larvae had already emerged from hibernation under the coverings of the eggs on it, as they had also done on early apples. It is suggested that the larvae cannot find buds sufficiently advanced in development to permit mining.

[VERESHCHAGIN (B. V.).] **Верещагин (Б. В.). Pests of Grape Vine and their Control. (Based on Observations of 20 Years, 1913–1932, in Bessarabia.)** [*In Russian.*]—8vo, 16 pp. Chişinău, 1933. Price *Lei* 20.

This popular survey of pests and diseases of vines in Bessarabia includes brief notes on 20 insects and 2 mites, most of which have been recorded in papers already noticed [*R.A.E.*, A, xviii, 132; xix, 405].

UHLMANN (E.). **Zur Biologie und Bekämpfung der Holzwespe *Paururus juvencus* L.** [On the Biology and Control of the Wood-wasp, *Sirex juvencus*.]—*Mitt. Ges. Vorratsschutz*, viii, no. 6, pp. 65–68, 1 fig. Berlin, November 1932. [Recd. February 1933.]

Sirex (*Paururus*) *juvencus*, L., was particularly abundant in Thuringia in 1931, emerging chiefly from beams and boards of pine, rarely from spruce or fir [*Abies*]. The adults lived about 3–4 weeks without food. They were very sensitive to dry heat, especially in the absence of water, and died in a few days at 26°C. [78·8°F.]. In Thuringia 3 years appear to be necessary for development in stacked or worked timber, and constructional timber should be stored for 3 winters and then used in the autumn, so as to ensure its freedom from infestation. No eggs are laid in dry wood or in healthy trees with a vigorous flow of sap.

ZACHER (F.). **Brasilianische Speicherschädlinge.** [Brazilian Warehouse Pests.]—*Mitt. Ges. Vorratsschutz*, viii, no. 6, pp. 68–72. Berlin, November 1932. [Recd. February 1933.]

A list of Brazilian warehouse pests is quoted from a work by Costa Lima [*R.A.E.*, A, xvi, 416], and the following are recorded from S. Paulo: *Rhizopertha dominica*, F., and one individual of *Silvanus* (*Oryzaephilus*) *surinamensis*, L., in barley; and *Gnathocerus* (*Echocerus*) *cornutus*, F., *Laemophloeus minutus*, Ol., *Cathartus cassiae*, Reiche, and *Calandra zea-mais*, Motsch., in maize cobs.

RUHDOLF (L.). **Zur Verbreitung der Samenkäfer.** [On the Distribution of Seed-infesting Coleoptera.]—*Mitt. Ges. Vorratsschutz*, ix, no. 1, pp. 10–11. Berlin, January 1933.

Instances of field infestation in 1931 of peas by *Bruchus pisorum*, L., and of broad beans by *B. rufimanus*, Boh., are recorded in the Hamburg district.

ZACHER (F.). **Ein neuer Vorratsschädling in Deutschland** (*Aphomia gularis* **Zell., Lep. Pyralidae**). [A new Pest of stored Products in Germany.]—*Mitt. Ges. Vorratsschutz*, ix, no. 1, p. 11. Berlin, January 1933.

An adult of the Pyralid, *Aphomia gularis*, Zell., was recorded from a cacao warehouse in Hamburg in September 1932. This is a new record for Germany.

REICHERT (A.). **Rosenschädlinge. 21.** *Operophthera brumata* **L.** [Rose Pests. 21. *Cheimatobia brumata*.]—*Die kranke Pflanze*, x, no. 1, pp. 1–3, 1 pl. Dresden, January 1933.

Cheimatobia (*Operophthera*) *brumata*, L., is common on roses in Germany. Near Leipzig it is associated with *Tortrix viridana*, L., in defoliating oaks, and in mountain districts it has adapted itself to *Vaccinium myrtillus*. The larvae are parasitised by the Braconid, *Meteorus ictericus*, Nees, which in turn is attacked by an Ichneumonid hyperparasite, *Hemiteles areator*, Panz.

BODENHEIMER (F. S.). *Icerya purchasi* **Mask. und** *Novius cardinalis* **Muls.**—*Z. angew. Ent.*, xix, no. 4, pp. 514–543, 8 figs., 6 refs. Berlin, December 1932.

A detailed account is given of observations in 1928–31 at Chederah, Palestine, on an infestation of 100 acres of orange groves by *Icerya purchasi*, Mask., and the value in its control of the predacious Coccinellid, *Rodolia* (*Novius*) *cardinalis*, Muls.

In the coastal zone of Palestine *I. purchasi* has 6–7 generations in two years. The last generation of the year forms its egg-sacs at the end of January, and the females of the first generation do so in May. The females of the second oviposit in August. In warm years development is accelerated, so that the third generation forms its egg-sacs in October–November instead of in January. Egg-counts during 3½ years gave an average of 169 eggs per female. Food influenced the production of eggs, the average number laid on *Spartium junceum* being 64·5 per cent. of that on orange. *S. junceum* is a relatively favourable food-plant, so

that there must be greater disparity with less suitable ones. Temperature by itself had little effect, the average number of eggs being 200 at 12–20°C. [53·6–68°F.], 162 at 20–25°C. [77°F.], and 168 at 25–29°C. [84·2°F.]. Moisture by itself also had little effect, but moist heat provided the optimum condition. The food-plants of *I. purchasi* are very numerous, but in spite of this very little is known of its food-ecology. Many records appear to be based merely on the presence of females with ovisacs ; thus potato is a recorded food-plant, whereas in the author's experiments adult females formed ovisacs on it, but the young larvae did not attach themselves and died of starvation. Numbness through cold was observed at 19·C. [66·2°F.] for young larvae and at 16·7°C. [62·06°F.] for young females; normal activity occurred at 22·5°C. and 27·5°C. [72·5°F. and 81·5°F.] respectively, and death through heat at 38·9°C. and 42·2°C. [102·02°F. and 107·96°F.]. *I. purchasi* is a tropical insect capable of living in the subtropics where temperature and moisture are favourable. It is absolutely limited by cold and by a high degree of dry heat.

R. cardinalis was introduced into Palestine about 1912. The author has investigated the effect of temperature on its development and gives a calculated curve agreeing substantially with empirical data. The most rapid development required 86 days at 13·8°C. [56·84°F.] and 16 days at 28·2°C. [82·76°F.]. Mating occurred on emergence. The pre-oviposition period lasted 3–4 days in summer and 1–3 weeks in winter. In the coastal zone development continued at a retarded rate throughout the winter. The eggs were laid singly in or on the egg-masses of *I. purchasi*. The egg, larval and pupal stages lasted 2–9, 5–37 and 6–35 days respectively. The males lived 20–216 days, and the females 16–178, ovipositing almost throughout life. A maximum of 1,037 eggs per female and a minimum of 35 were observed, the averages being 198 in winter and 335 in summer. The adults became numb at 11·9°C. [53·42°F.] and the larvae at 16·9°C. [63·42°F.]. Normal activity was observed at 15·5–38·5°C. [59·9–101·3°F.] and 23·5°C. [74·3°F.] respectively, and death through heat at 43°C. [109·4°F.] and 41·3°C. [106·34°F.] A damp, cold winter was unfavourable to *R. cardinalis*, prolonged dry heat coming next as an adverse condition. Contrary to Poutier's findings [*R.A.E.*, A, xviii, 365], scales on *Spartium junceum* were readily destroyed by *R. cardinalis*, and infestation of this plant ensures a permanent focus of the Coccinellid in the district.

The results of an attempt to ascertain the influence of *R. cardinalis* on the population of *I. purchasi* are discussed in detail. At higher temperatures it produces a greater number of generations in relation to those of the scale. Figures given show that if it is present in the proportion of 1–2 per cent. of the scale population, it can destroy all the scales during the next generation of the latter. Its great activity and the fact that it is widely spread by wind are further favourable factors, so that a climatic mortality of 37 per cent. observed in Palestine is of negligible importance. Biological control is most effective when its population is between 10 and 15 per cent. of that of *Icerya*. After any further increase, it so rapidly destroyed the scale that its search for food, oviposition, etc., was hampered and its numbers decreased. Where *I. purchasi* was scarce, however, attack by *R. cardinalis* was slight, and this prime factor of population density of the scale interferes with theoretical calculations. Very good results were achieved at a low cost at Chederah by collecting the ovisacs and breeding and

releasing the Coccinellids from them. Collection of the ovisacs is best done where the scale shows an increase (in July and August).

In 1928, orange leaves and fruits in some groves were covered with a sooty fungus, which was erroneously ascribed to *Ceroplastes floridensis*, Comst., which was present in abundance. It was, however, discovered that *C. floridensis* secretes very little honey-dew.

KIRSCHNER (R.). **Beurteilung der Giftwirkung gasförmiger Insecticide auf Grund der Schlagfrequenz des Dorsalgefässes.** [The Valuation of the toxic Effect of Gas Insecticides based on the Rapidity of Beats of the dorsal Heart.]—*Z. angew. Ent.*, xix, no. 4, pp. 544–556, 5 charts, 7 refs. Berlin, December 1932.

In these experiments the action of respiratory insecticides was tested by observations of the pulsation of the dorsal heart of a tulip Aphid. The tests were made in glass jars, 30 drops of each liquid being soaked in cotton wool for evaporation at a temperature of 23°C. [73·4°F.]. As a preliminary the normal "pulse" was ascertained at various temperatures. Temperatures of 10–30°C. [50–86°F.] were regarded as normal, the average being 75·08 to 88·87 beats a minute. At 5°C. [41°F.] the average was 56·18; at 35°C. [95°F.] it rose to 101·28; at 40°C. [104°F.] it was only 36·67; and at 50°C. [122°F.] the heart ceased beating. Ten insecticides were tested, and the results are discussed. Oil of myrbane and 40 per cent. formaldehyde were slow-acting. Acetone, chloroform and benzene acted very rapidly, but are unlikely to be used in practice. Carbon bisulphide caused the heart beats to stop in 4–7 minutes without any subsequent recovery. The fumes of burning tobacco dust had the most rapid action of all the insecticides tested, 2–3 minutes sufficing to affect the insects fatally. With a mixture of 2 parts ethyl acetate and 1 part carbon tetrachloride, the heart beats of all the Aphids stopped in 11 minutes, and they did not recover. Ethyl acetate alone produced very weak and irregular heart beats, and carbon tetrachloride alone caused death in 13 minutes. Several of the substances tested are not suitable for the control of pests on plants; their chief use would be in warehouses.

ASS (M.) & FUNTIKOW (G.). **Ueber die Biologie und technische Bedeutung der Holzwespen.** [On the Biology and technical Importance of Wood-wasps.]—*Z. angew. Ent.*, xix, no. 4, pp. 557–578, 19 figs., 34 refs. Berlin, December 1932.

Information in the literature on the biology of wood-wasps (SIRICINAE) and the importance of the injury they cause is reviewed, and a summary is given of the results of a study made by the authors from 1928 to 1931 with material from 2 previously injured spruce trees near Leningrad, the species concerned being *Sirex gigas*, L., *S.* (*Xeris*) *spectrum*, L., and *S.* (*Paururus*) *juvencus*, L. The flight-dates observed are recorded and compared with those in other countries. Three parasites, *Rhyssa amoena*, Grav., *R. persuasoria*, L., and *Ibalia leucospoides*, Hohenw., were observed in the forest. No explanation was found for the already well-known variation in size of the wood-wasps. It would seem that light and heat increase oviposition activity, but oviposition was observed in rainy weather. The mechanism of

oviposition boring and the larval mines of *S. juvencus* are described, with notes on the depth to which these latter penetrate the timber, which probably averages about 3 ins.

Pang Hwa Tsai. **Das Reiszünslerproblem in China.** [The Rice-borer Problem in China.]—*Z. angew. Ent.*, xix, no. 4, pp. 608–614, 5 diag. Berlin, December 1932.

The stem-borers, *Schoenobius bipunctifer*, Wlk., and *Chilo simplex*, Butl., are the most serious pests of rice in China, destroying about 3–6 million tons or 10–20 per cent. of the total crop annually. Reliable observations have only been made comparatively recently, when the outbreaks increased, *S. bipunctifer* being so injurious that the entire crop was sometimes lost in districts near Shanghai. It is probably an imported species, and in the south-eastern provinces (Kiangsu and Chekiang) it usually has three generations a year, a fourth occurring if the autumn weather is favourable. *C. simplex* usually has two generations in Chekiang, with an occasional third. Otherwise the bionomics of the two species are similar. The moths emerge in spring and lay 50–100 eggs (sometimes 300 in the case of *C. simplex*) in 5 or 6 masses on rice leaves ; the summer generations prefer the stems. The young larvae soon bore into the stems, those of *C. simplex* first feeding on the leaf-sheaths for a few days. When the injured plants begin to wither, the larva attacks others, *C. simplex* being able to destroy over 10 plants, and *S. bipunctifer* 2 or 3. Pupation takes place in the stem. In autumn the injury results in the production of blind ears. The larva of *S. bipunctifer* usually hibernates in the stubble and that of *C. simplex* in the straw. Mortality during hibernation is higher in the case of *S. bipunctifer*, which seems the more sensitive to weather conditions. In spite of this, it does two or three times as much damage as *Chilo*, owing to its more numerous generations and especially to the fact that the larvae spread to a larger number of plants. As a rule only 1–3 larvae occur in a stem as against an average of 12 for *C. simplex* [*cf. R.A.E.*, A, xxi, 104].

Observations from 1919 to 1929 show that climatic factors influence the outbreaks. Climatograms are given indicating that an outbreak of *S. bipunctifer* may be expected if the temperature in August and September has been higher than usual, so that an additional generation is produced, and the rainfall from October to March has been low, with a consequent reduction in larval mortality. A winter mortality of 70–80 per cent. of the larvae of *S. bipunctifer* was observed in damp, low-lying fields as compared with 40–50 per cent. in dry ones. Control may best be effected by measures against the hibernating larvae. In one district in Chekiang the fields are flooded in winter by water from a lake. In districts in which the rice-stubble is burnt, injury by *Schoenobius* does not occur. In spring the escape of adults resulting from larvae of *C. simplex* hibernating in rice-straw may be prevented by heaping up the straw and covering it. Light-traps are costly and unreliable, but hand collection of eggs, though also expensive, has proved effective, the authorities paying for eggs collected. As about 70 per cent. of these are parasitised, chiefly by *Trichogramma japonicum*, Ashm., they are specially stored. Late planting out of the seedlings reduces infestation, probably owing to retardation of development. The eggs of these Pyralids are also parasitised by *Phanurus* (*Ceraphron*)

beneficiens, Zehnt., and the larvae by *Centeterus alternecoloratus*, Cush., *Angitia chilonis*, Cush., and *Chelonus munakatae*, Munakata (*chilonis*, Cush.).

Zwölfer (W.). **Die Unterscheidung von Spannerpuppen aus der Lebensgemeinschaft des Kiefernwaldes.** [The Recognition of Pupae of *Bupalus piniarius* in the Biocoenosis of Pine Forests.]—*Z. angew. Ent.*, xix, no. 4, pp. 614–617, 2 figs. Berlin, December 1932.

The pupae of several other Geometrids occur together with those of *Bupalus piniarius*, L., in the forest-litter of pine woods in Germany and may lead to errors in counts made with a view to forecasting its abundance. A key, based on the cremasters, is therefore given to the pupae of *B. piniarius* and the 8 other species likely to be found.

Goffart (H.). **Versuche zur Bekämpfung der Kohlfliege** (*Phorbia brassicae* **Bché.**). [Experiments in the Control of the Cabbage Fly, *P. brassicae.*]—*Z. PflKrankh.*, xliii, no. 2, pp. 49–68, 5 figs., 29 refs. Stuttgart, February 1933.

Phorbia brassicae, Bch., is a permanent pest of cabbage and allied plants in Schleswig-Holstein. This paper describes experiments against it with disks, repellents, and insecticides. The best control was obtained by spraying with 0·06 per cent. mercury bichloride on the 4th and 14th days after planting out ; a single application between the 4th and 6th days was also fully effective, though one application may not always suffice. The cost of treatment with naphthalene was only very slightly higher and was still quite economic, but naphthalene only acts as a repellent. Tar-distillates used in a 0·3 per cent. solution mixed with sand and spread round the plants proved of considerable value, the very low cost compensating for a slight infestation of 2·1 per cent. of the plants after treatment.

Blunck (H.). **Starker Frass der kleinen Lärchenblattwespe** *Lygaeonematus laricis* **Htg. an japanischer Lärche.** [A severe Attack of Japanese Larch by the small Larch Sawfly, *L. laricis.*]—*Z. PflKrankh.*, xliii, no. 2, pp. 77–85, 5 figs., 24 refs. Stuttgart, February 1933.

The larch sawfly, *Lygaeonematus laricis*, Htg., is usually unimportant in Germany, but an infestation of *Larix leptolepis* (*kaempferi*) has existed in Schleswig-Holstein for 3 years, a small stand of 10-year-old and a large one of 7-year-old trees being partly defoliated. As the area is one of about 600 acres, it is proposed to use a calcium arsenate dust in 1933 instead of arsenical sprays, which were tested on a small scale with varying success in 1930 and 1932.

Nitsche (G.). **Methoden zur Prüfung von Pflanzenschutzmitteln. 3. Die Bestimmung des Wachslösungsvermögens von Blutlausmitteln.** [Methods for Testing Insecticides and Fungicides. 3. The Determination of the Wax-solvent Power of Insecticides against the Woolly Aphis.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 2, pp. 9–10, 1 fig. Berlin, February 1933.

It is easy to combine wax-solvents with insecticides that are painted on the trunks of apple trees against *Eriosoma lanigerum*, Hausm., but

in sprays they usually injure the leaves. The wax-solvent properties of sprays are therefore usually slight and difficult to gauge. Two methods used for determining their value are described. In the first, pieces of infested branches are dipped for two seconds in the solution and its solvent power gauged by comparison with a good solvent such as xylol. Its insecticidal action can be followed by observation of the further development of the Aphid colonies. In the second method a measured quantity of the solution is placed in a watch-glass and some of the Aphids are laid on the surface. The woolly threads disappear rapidly in a good solvent, the time taken being the measure of efficiency.

ZIEBARTH (F.). **Die hauptsächlichsten starken Schäden an Forstgehölzen im Jahre 1932.** [The chief Cases of serious Injury to Forest Trees in Germany in 1932.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 2, pp. 10–11. Berlin, February 1933.

Very brief notes are given on the distribution of a large number of insects attacking forest trees in various parts of Germany.

[VERESHCHAGIN (B.).] **Верещагин (Б.). The Locust in the Delta of Danube in 1931.** [*In Russian.*]—*Furnica*, no. 8, extract 4 pp., 2 figs. Kishinev, 15th April 1932.

Owing to the high floods of the Danube during the winter of 1930–31, many egg-deposits of *Locusta migratoria*, L., on the islands in the delta were under water and the eggs failed to hatch. The infested territory occupied an area of about 42,000 acres. Only mechanical methods of control, particularly trenching, were adopted, and 40–100 per cent. of the hoppers were destroyed. The new egg-deposits occupy about 990 acres.

SAVASTANO (G.). **Il mosaico del Fagiolo in Italy.** [Bean Mosaic in Italy.]—*Boll. R. Staz. Pat. veg.*, xii, no. 4, pp. 377–394, 3 figs., 4 pls., 18 refs. Rome, 1932. [Recd. February 1933.]

An account is given of a mosaic disease of beans observed near Rome and found to be transmissible through the seed. Large numbers of *Aphis (Doralis) fabae*, Scop., were present on the infected leaves.

ANDRÉ (M.). **Contribution à l'étude du " Bou-Faroua " Tétranyque nuisible au dattier en Algérie.**—*Bull. Soc. Hist. nat. Afr. N.*, xxiii, no. 9, pp. 301–338, 15 figs., 4 pls., 37 refs. Algiers, December 1932.

Further investigations on the Tetranychid mite that infests date palms in Algeria [*R.A.E.*, A, xx, 267, 671 ; xxi, 144] were carried out in the summer of 1932. It attacks all varieties of dates with equal readiness and causes serious injury to the inflorescences and fruits, having been responsible for losses of 50 per cent. or more of the crop in some districts. A detailed description is given of the adults of both sexes and briefer ones of the larva, protonymph and deutonymph, together with descriptions quoted from the literature of the adults of *Paratetranychus simplex*, Banks, and *P. heteronychus*, Ewing, both of which are known as pests of dates in California and the former also in

Iraq. On the basis of its morphological characters, the author identifies the Algerian mite as *P. simplex*. The bionomics of the Tetranychid mites are discussed from the literature. It has not been ascertained whether *P. simplex* overwinters as a mature female, as do species of *Tetranychus*, or in the egg stage like other species of *Paratetranychus*. In the course of the summer ten generations may be produced, the eggs hatching in 7–12 days. As the eggs are not affected by sulphur dust [xx, 267], the application should be repeated after they have had time to hatch.

Atkinson (D. J.). **On Insect Damage to the Timber of Teak** (*Tectona grandis*).—*Burma For Bull.*, no. 26 (Zool. Ser. no. 2), 13 pp., 12 pls. Rangoon, 1931. [Recd. February 1933.]

A brief account, intended primarily for the use of forest officers, is given of the insects boring in teak (*Tectona grandis*) in Burma. Although the Cossid, *Xyleutes ceramica*, Wlk. (bee-hole borer), is undoubtedly the most serious of these, much of the damage attributed to it is the work of other insects, and the individual damage caused by the Hepialid, *Phassus signifer*, Wlk., or the Lamiid, *Aristobia approximator*, Thoms., greatly exceeds that caused by any individual larva of *Xyleutes*. Other insects causing slight or superficial damage are the Lamiids, *Apriona swainsoni*, Hope, *Dihammus cervinus*, Hope, *Glenea* (*Stiroglenea*) *indiana*, Thoms., and *Nupserha variabilis*, Gah., and the Cerambycid, *Gelonaetha hirta*, Fairm. The adult and larva of each insect are briefly described and details are given of type of injury caused, illustrated in each case by photographs of both insect and injury to facilitate recognition in the field.

Atkinson (D. J.). **Entomological Research.**—*Ann. Rep. Silv. Ent. Burma*, 1928–29, pp. 64–75 ; 1929–30, pp. 60–69, 3 pls. ; 1930–31, pp. 60–69. Rangoon, 1929–31. [Recd. February 1933.]

Life-history studies of *Xyleutes ceramica*, Wlk. (bee-hole borer), the most serious pest of teak [*Tectona grandis*] in Burma, have been carried out since 1928 in an out-door breeding cage. Larvae collected in infested teak plantations were successfully transferred to holes artificially bored 2 inches deep in living trees within the cage. Each hole was covered with a small bottle, tied firmly and attached with a plasticine joint, to catch any parasites that might emerge and to facilitate the determination of the working periods of the larvae by observations of ejected frass. Of the larvae introduced early in September 1928, which were tentatively graded into six classes according to size and general appearance, 2 became adults by the end of the year, 5 did so at somewhat widely spaced intervals during 1929, and 9 in March-April 1930, representing undoubted cases of a 2-year life-cycle. The pupal period, as calculated from the date of cessation of ejection of frass till that of the emergence of the adult, occupied 7–17 weeks, with a tendency towards the minimum. Eggs laid in March by newly-emerged females hatched between 4th and 13th April, after an average incubation period of 20–25 days. Observations showed that the moths are not attracted to lights. Records of alternative food-plants of *X. ceramica* include the finding of a larva in *Callicarpa arborea* in 1921, and what appeared to be part of a pupal skin in a swelling on the stem of *Clerodendron* in 1919, neither of which has the author been able to corroborate in inspecting trees of these species.

Parasites of the larvae include two unidentified Tachinids [one of which is *Podomyia atkinsoni*, Aub. (*R.A.E.*, A, xx, 192)], the highest rate of parasitism by which was 8·1 per cent., and an unidentified Ichneumonid, which was reported to have caused 10·9 per cent. parasitism in one plantation. Ants are believed to destroy the larvae occasionally, *Sima rufonigra*, Jerd., which uses the bee-holes as entrances into its galleries, probably disposing of any larvae living in them. The most important enemies, however, are undoubtedly woodpeckers. Analysis of 26 trees with 258 bee-holes gave a moth percentage of only 14·3, and of the 85·7 per cent. of failures less than 6 per cent. were attributable to parasitism, woodpeckers being responsible for the remaining 80 per cent. Furthermore, only 5 per cent. were cases of excavation for the mature larva or pupa, 75 per cent. being due to extraction of the larva through the opening of the bee-hole. It is estimated that the larger species are able to extract larvae in this manner from a depth of 4½ inches.

In view of the probability that the life-cycle normally extends to two years, and as there is evidence that the larvae can vacate galleries no longer suitable and construct others, the time of thinning the trees is of little importance in reducing the numbers of *X. ceramica*. Whenever thinning takes place, first-year larvae will probably die and second-year larvae will do likewise unless sufficiently mature, in which case felling will make no difference to successful emergence.

Studies of the Pyralid, *Hapalia machaeralis*, Wlk., and the Noctuid, *Hyblaea puera*, Cram., which defoliate teak, and of their parasites were begun in 1930 in a specially constructed insectary. Seven successive generations of *H. machaeralis* were reared, and numbers of parasites and hyperparasites, including 32 unidentified species of Ichneumonids, Braconids, Tachinids and Chalcids were obtained, and one of the Braconids showed promise of being distinctly important. It mates and feeds readily in captivity, the adults live on an average for 42·6 days, and the females are apparently capable of parasitising as many larvae of *H. machaeralis* as can be given them, 548 larvae in 10 days being the present maximum. The parasite larva leaves the host after it has prepared its cocoon but before it pupates, only one developing in each host. Defoliation by *H. puera*, the larvae of which can feed only on tender leaves, occurs earlier in the season and is less severe than that caused by *H. machaeralis*, which can survive on older and tougher foliage. *H. puera* is consequently more difficult to rear in the insectary, where only 4 generations have been bred. This species, however, shows a tendency to hibernate, many adults of the last generation having lived for over 3 months, and being still alive at the time of recording. Various parasites, including Nematodes, were reared from *H. puera*, but material was insufficient to carry out breeding experiments with any of them. In several cases numerous Braconid larvae followed by a single Tachinid larva were observed to emerge from the same host larva.

Other pests of teak, on which brief notes are given, include the Lamiids, *Aristobia approximator*, Thoms., which was also found infesting *Peltophorum ferrugineum* in 1930, *Apriona swainsoni*, Hope, the larva of which feeds in a gall-like swelling on a creeper (*Butea superba*), pupation taking place in the teak supporting the creeper, and *Dihammus cervinus*, Hope, which appears to be highly polyphagous and to have one generation a year in Burma, practically all the adults bred in the insectary having emerged during May or early June.

Pests of trees of economic importance other than teak include the Cassidid, *Calopepla leayana*, Latr., which defoliates *Gmelina arborea*, and *Cyriopalpus wallacei*, Pasc., which attacks *Pentacme suavis*, showing a preference for green, healthy trees or branches $1\frac{1}{2}$–3 ft. in girth. Not more than 2 or 3 individuals of this Cerambycid are usually found in a tree.

Life-history studies of *C. leayana* were begun in 1929 with two pairs of hibernated beetles collected on 2nd June, which gave rise to two generations, the second going into hibernation about the end of November. A continuation of these studies in 1930 showed that there is a partial third generation. Hibernation occurs in the adult stage beneath the loose bark of dead trees or fence posts. One female, which emerged in the first half of August 1930 and lived until 12th February 1931, laid 23 egg masses between 5th September and 20th October. The collection of 15,000 beetles as they emerged from hibernation in May 1930 was not sufficient to prevent serious defoliation in the following season, but it is hoped that this measure at the beginning of the rains combined with trapping during the cold weather will keep the beetle in check. Experimental dusting with calcium cyanide against both beetles and larvae proved entirely ineffective. Investigations of the life-history of an unidentified Chalcid parasite of *C. leayana* have also been begun. Oviposition occurs in the mature larva or fresh pupa of the host, only one adult parasite emerging although more than one egg may be laid. One isolated female, which lived from 22nd July till 6th September, parasitised 200 larvae and pupae and would doubtless have attacked many more had they been available. The pre-adult life is normally about 21 days but may be prolonged in cold weather. The parasite appears to be capable of hibernation in the adult stage.

Wood Borers in Australia. Part II. *Anobium*, **or the Furniture Borer.** —*Trade Circ. Div. For. Prod. Coun. Sci. Ind. Res. Aust.*, no. 11, 14 pp., 4 figs. Melbourne, 1932.

This paper is the second of a series on wood-borers in Australia [*cf. R.A.E.*, A, xx, 270] and deals with the bionomics and control of beetles of the genus *Anobium*. The timbers attacked and the conditions under which infestation occurs are discussed. A table showing the distinguishing characters of the chief groups of wood-boring beetles is repeated.

JARVIS (E.). **Cane Pest Combat and Control. The Grey-back Beetle.**—*Queensland Agric. J.*, xxxviii, pt. 6, pp. 472–475, 1 fig. Brisbane, 1st December 1932.

In Queensland, the adults of the grey-back cockchafer [*Lepidoderma albohirtum*, Waterh.] emerge from the soil at about 7.15 p.m. after the fall of 3–5 ins. of rain towards the end of November or the middle of December [*cf. R.A.E.*, A, xiv, 96]. Pairing occurs that evening, and the pre-oviposition period (occupying 10–14 days) is passed on various trees, where the beetles are fully exposed to climatic conditions and to the attacks of Tachinid parasites during the day. The evening flight, during which the beetles are greatly attracted to light, usually begins soon after 7 p.m., and its duration is greatly influenced by temperature, humidity and illumination. The beetles have been observed flying westwards in large numbers 2–4 ft. apart at a height of 15–20 ft.

A maximum of 36 eggs are laid at night in a chamber under the sugar-cane stool a foot or more below the surface of the ground. The larvae hatch after about 10 days and migrate to the fibrous roots surrounding the underground basal parts of the cane sticks.

About 70 or, in the case of a second period of emergence, about 100 days should elapse between oviposition and the fumigation of the soil.

ATHERTON (D. O.). **Pests of Cotton in the Callide Valley.**—*Queensland Agric. J.*, xxxviii, pt. 6, pp. 488–492, 2 refs. Brisbane, 1st December 1932.

An account is given of five species of Lepidoptera that caused damage to cotton in the Callide Valley, eastern Queensland, during the 1931–32 season, which was abnormal owing to sustained high temperatures and low rainfall. *Bucculatrix gossypii*, Turn. (cotton leaf perforator), which had not previously been regarded as a pest, caused considerable injury. The older, more fleshy leaves are the first to be attacked, and in mild infestations the larvae are confined to the few leaves nearest the ground. In severe infestations, however, fully grown leaves on any part of the plant may be attacked, and in the worst cases feeding sites were so numerous as to give a skeletonised appearance to most of the larger leaves and severely check the growth of the plant. The young larva mines in the leaf for some days and then emerges from the mine and passes through a resting phase under the shelter of a circular, silky, yellowish structure on the leaf surface. When this phase is completed, it feeds externally on the leaf lamina, removing small distinctive shot-hole areas, which are often $\frac{1}{8}$ inch across. The pupa is formed in a yellowish silken cocoon, which is closely pressed to a substratum of leaf surface, stem or clod of soil.

Only one instance of damage by *Euxoa radians*, Gn. (brown cutworm) was observed, and the very young cotton destroyed in this case had been planted on land previously overgrown with a weed (*Tribulus terrestris*) while lying fallow. *Heliothis obsoleta*, F., though regarded for some years as the most serious pest of cotton in the Callide Valley, caused little injury in 1931–32. The first eggs were discovered late in December 1931 on young cotton planted earlier in the month at the advent of the rains and hatched at the end of January, but oviposition only reached its maximum in the first week in February. The largest numbers of larvae were present a week later and, especially on maize, towards the end of the month, after which their activity decreased until it practically ceased by the end of March. The larvae were parasitised by several Tachinids, and predators included Sphegids and the Pentatomid, *Oechalia consocialis*, Boisd.

Earias huegeli, Rogenh. (rough bollworm), which had not previously been considered a serious pest of cotton in Queensland, caused greater losses during the past season than any other cotton pest, 50 per cent. of the squares being destroyed in many cases. Terminal losses and the loss of tiny squares were first noticed in January 1932, and the injury steadily increased until the end of March, afterwards remaining fairly constant until observations ceased at the end of April. Natural enemies observed were Tachinids, a small Braconid and *O. consocialis*.

The Noctuid, *Antarchaea chionosticta*, Turn. (MS.), which is recorded for the first time as a pest of cotton in Queensland, appeared in large numbers and caused very severe injury. The youngest larvae feed on the leaf tissue between the veins of young leaves, whereas the larger ones

eat almost the whole of the leaf lamina, leaving only the larger veins of the succulent young growth, although harsh old foliage is avoided. Indiscriminate feeding on succulent tissues often results in severe losses of terminal growing shoots, including the tiny squares. Larger squares are sometimes attacked, but no instance of damage to bolls was noticed. All stages of this moth are briefly described, and the characters distinguishing the egg from that of *H. obsoleta*, which it closely resembles, are indicated. Eggs are laid anywhere on the foliage or squares, but usually on the succulent leaves near the apices of vegetative branches. The larvae pupate at or just below the surface of the soil near the base of the plant in a flimsy cocoon, and the pupal stage lasts 8–12 days. All stages of *A. chionosticta* were present from the third week of December until March, but both larvae and moths were found in greatest numbers in February. A sudden cessation of activity after March is thought to have been due to the cumulative effect of natural enemies, which include the Sphegid, *Ammophila suspiciosa*, Sm. ; *Brachymeria* (*Chalcis*) *ruskini*, Gir., and *B.* (*C.*) *rufifemur*, Gir., which parasitised 70 per cent. of the pupae collected in February and March ; Tachinids; and *O. consocialis*. The importance of this Pentatomid as a predator on Lepidopterous larvae is reduced by the fact that most of the eggs laid early in the season are parasitised by *Telenomus* sp. and *Pachycrepis tectocorisi*, Gir.

de Fluiter (H. J.). **Het uitkomen van de imago van *Diplostichus tenthredinum* B.B. (nec. *janithrix* Hartig apud Stein) (Baranoff) (Diptera, Tachinidae) uit den gesloten cocon van *Diprion pini* (L.).** [The Emergence of the Adult of *Diplostichus tenthredinum* from the closed Cocoon of *D. pini*.]—*Ent. Ber.*, viii, no. 188, pp. 417–420. Amsterdam, 1st November 1932. [Recd. February 1933.]

The author discusses the manner in which the Tachinid, *Diplostichus tenthredinum*, Br. & Berg. (which is regarded as distinct from *D. janithrix*, Htg.) emerges from the hard cocoon of *Diprion pini*, L., and refers to a paper by Scheidter [*R.A.E.*, A, vii, 452], in which it was shown that the exit is prepared for the adult by the larva cutting the circular aperture. He no longer considers *Pteronus* to be the correct name for the genus *Diprion* [*cf.* xx, 659]. In a supplementary note [pp. 420–421] Dr. J. T. Oudemans points out that a divergent finding by Prell on the question of emergence [xiii, 208] refers to another Tachinid, *Ceromasia inclusa*, Htg., and to another sawfly, *D.* (*Lophyrus*) *frutetorum*, F.

Muller (H. R. A.). **Ambrosia Fungi of tropical Scolytidae in pure Culture.** [*In Dutch.*]—*Versl. Afd. Ned. Oost-Indië ned. ent. Ver.*, i, no. 4, pp. cv–cvii, cxxv. Amsterdam, 1st January 1933.

Observations in the Netherlands Indies have shown that the ambrosia fungi of *Xyleborus haberkorni*, Egg., *X. morstatti*, Hag., *X. morigerus*, Bldf., and *X. bicornis*, Egg., are very similar and belong to the *Monilia* type. *X. morstatti* lived for 24 days on a pure culture, but failed to reproduce. Examples of *X. morstatti* from coffee (*Coffea robusta*) appeared to able feed on the ambrosia of *X. morstatti* from *Sambucus canadensis* and on that of *X. haberkorni* from mahogany (*Swietenia mahagoni*). In connection with the fact that certain Scolytids are known to transport fungi that infest plants [*cf. R.A.E.*, A, xviii, 177, etc.], it is possibly significant that *X. morstatti* often carried on its body

the spores of *Fusarium* growing in its older mines with the ambrosia fungus. *X. destruens*, Bldf., likewise carried the spores of a *Fusarium* found in its mines in teak. A further note (p. cxxv) records the breeding of *X. morigerus* from egg to adult on a pure culture of its ambrosia fungus.

Leefmans (S.). **Biological Particulars about *Cirrochroa tyche* and *fasciata* (Lepid.); *Achroia grisella*, a Pest of Wax-covered Wires in a Telephone Plant.** [*In Dutch.*]—*Versl. Afd. Ned. Oost-Indië ned. ent. Ver.*, i, no. 4, pp. cxxviii–cxxx. Amsterdam, 1st January 1933.

In Java the larvae of the Nymphalids, *Cirrochroa tyche*, Fldr., subsp. *moeris*, Fruhst., and *C. fasciata*, Fldr., subsp. *bilbilis*, Fruhst., attack the leaves of Flacourtiaceae, the seeds of which produce chaulmoogra oil used in the treatment of leprosy. In cases in which the damage justified spraying, lead arsenate proved effective. *C. tyche moeris* was observed on *Taraktogenos heterophylla*, *T. kurzi*, *Hydnocarpus alpina*, *H. anthelmintica*, and *H. setumpul*, but very little feeding took place on the last-named. The eggs were laid on the lower surface of the leaves and hatched after 3–4 days or more, the larval and pupal stages lasting 9–11 and 6–7 days respectively. *C. fasciata bilbilis* occurred on *T. kurzi* and *H. anthelmintica*. The eggs were laid in chains and required at least 3 days to hatch, the larval and pupal stages lasting 11–12 and 4–5 days.

Achroia grisella, F., caused short circuits in the central telephone exchange at Weltevreden by eating the wax and cotton sheaths of the wires. Coating the wires with rubber solution effectively protected them.

Pacheco Herrarte (M.). **Las Plantas que se han usado como Barbasco. Se investiga su empleo como insecticidas.** [The Plants that have been used in the same Manner as the Barbasco Fish-poison. Investigation of their Use as Insecticides.]—*Rev. agric.*, xi, no. 1, pp. 24–25. Guatemala, 1st January 1933.

A list is given of Guatemalan plants that have or may have insecticidal properties, which are being investigated.

Wille (J.). **Informe . . . sobre la visita de inspección que ha practicado en el valle de Chincha del 10 al 15 de Enero de 1932.** [Report of the Entomologist on a visit of Inspection to the Chincha Valley, 10th–15th January 1932.]—*Mem. Junta direct. Soc. nac. agrar.*, 1931–32, pp. 170–173, 1 fig. Lima, 1932. [Recd. February 1933.]

In January 1932 little injury to cotton by *Dysdercus ruficollis*, L., was noticed in the Chincha valley, Peru, though it had been abundant in September-November 1931 in newly-planted fields. In January the only fields affected were those where the plants were well advanced owing to early irrigation. None of the females had mature ovaries, because their food was unsuitable, the seeds in the bolls being immature [*R.A.E.*, A, xix, 498]. In high-lying situations about 50 per cent. of the stainers were parasitised by a Tachinid, *Acaulona peruviana*, Towns., but only about 8 per cent. in low-lying ones. *D. ruficollis* infested a field of cucumbers very severely, the fruits falling

off while still undeveloped. There was a general infestation of cotton by a Coccid [*Pinnaspis minor*, Mask.], but it was heavily parasitised by Chalcidoids. *Aphis gossypii*, Glov., was largely controlled by natural enemies.

Wille (J.). **Informe . . . sobre la visita de inspección que ha practicado en el valle de Tambo desde el 25 de Noviembre al 7 de Diciembre de 1931.** [Report of the Entomologist on a Visit of Inspection to the Tambo Valley, Peru, 25th November–7th December 1931.]—*Mem. Junta direct. Soc. nac. agrar.*, 1931–32, pp. 177–181. Lima, 1932. [Recd. February 1933.]

The pests recorded include *Tarsonemus bancrofti*, Mich., on sugar-cane ; *Anticarsia gemmatalis*, Hb., against which a calcium arsenate dust is recommended, on lucerne ; and *Saissetia oleae*, Bern., and *Margaronia quadristigmalis*, Gn., on olives.

Clausen (C. P.) & Berry (P. A.). **The Citrus Blackfly in Asia, and the Importation of its Natural Enemies into Tropical America.**—*Tech. Bull. U.S. Dept. Agric.*, no. 320, 58 pp., 19 figs., 12 refs. Washington, D.C., August 1932. [Recd. February 1933.]

In view of the increasing importance of *Aleurocanthus woglumi*, Ashby, as a pest of *Citrus* in the West Indies and certain areas of Central America and the danger of its introduction into parts of the United States, investigations were begun in tropical Asia in 1929 on the possibility of its control by biological means. The steps leading to the undertaking of the investigations are recorded by C. L. Marlatt. The distribution, food-plants and bionomics of the Aleurodid and the effect of climate and other factors on its development are discussed. Notes are given on its natural enemies and the method of their introduction into Cuba from Asia, and their subsequent rearing and liberation are described.

The following is largely taken from the authors' summary : *A. woglumi* is present in the Philippines, southern China, Indo-China, Siam, Malaya, the Netherlands Indies, Burma, India and Ceylon, where it is rarely found on plants other than citrus and is of no economic importance, and also in Jamaica, Cuba, Haiti, Panama, Costa Rica and the Bahamas, where it infests a large variety of other plants, being particularly injurious to mango and coffee. Its development is chiefly influenced by humidity and rainfall, its numbers increasing most rapidly during the rainy season. The meteorological conditions in the citrus-producing areas of the United States indicate that it would constitute a major pest in Florida and the Gulf States should it become established there, but that it would not survive in California. Its comparative unimportance in the Far East is almost entirely attributable to the activity of its natural enemies, which include the Aphelinids, *Encarsia merceti*, Silv., in Malaya and the Netherlands Indies, *Eretmocerus serius*, Silv., throughout Malaya and the Netherlands Indies and also in Siam, Burma and Ceylon, *Prospaltella divergens*, Silv., in Malaya, Java and Sumatra, *P. smithi*, Silv., throughout the Far East, and two other species of *Prospaltella*, in Sumatra and Ceylon respectively ; the Nitidulid, *Cybocephalus* sp., in Java ; the Coccinellids, *Cryptognatha* sp., in Malaya and Sumatra, and three species of the genus *Scymnus* ; the Drosophilids, *Acletoxenus* sp., found in small numbers in Sumatra, and *A. indica*, Malloch, common in Java ;

Chrysopa sp., occurring generally in the Malayan region; and the Pyralid, *Cryptoblabes gnidiella*, Mill., in Johore and Sumatra. The Aphelinids cause an average mortality of 54–67 per cent. in each generation in the field, but the activity of all the species is reduced by 50 per cent. by hyperparasites of the genus *Ablerus*.

Colonies of *Eretmocerus serius* have been imported into Cuba, where 72–78 per cent. control was obtained in most cases within 8–12 months of the first liberations, and they have also been sent to the Panama Canal Zone, the Bahamas and Haiti [*cf.* *R.A.E.*, A, xx, 218, 428, 512]. The larvae feed externally on those of *A. woglumi* and internally on the pupae. Oviposition may take place on the larvae or pupae, but preferably on the larvae in the second instar. Two generations occur to one of the host. *Cryptognatha* sp. and *Scymnus smithianus*, Silv., which was collected in Sumatra, are established in Cuba, but the latter is not apparently adapted to conditions there, as reproduction is largely suspended during the summer. *Cryptognatha* has controlled at least one heavy infestation, but its effectiveness is so uncertain that it cannot be considered a reliable substitute for *E. serius*.

No indigenous parasites have been found in tropical America, though a number of predatory Coccinellids are present. Fungi, principally of the genera *Aschersonia* and *Aegerita*, at times kill a fairly large number of the larvae and pupae of *A. woglumi* in the West Indies, though they are of rare occurrence in Malaya, despite the apparently more favourable climatic conditions.

Entomology Section.—*Rep. Iowa Agric. Expt. Sta.* ***1931–32***, pp. 54–60, 2 figs. Ames, Iowa, 1932.

A brief review is given of work done in Iowa during the year ending 30th June 1932, some of which has been noticed previously [*R.A.E.*, A, xx, 412, 413]. Additional vectors of yellow dwarf disease of onions mentioned by C. J. Drake [*cf.* xx, 357, 706] include *Hyalopterus arundinis*, F. (*pruni*, F.), *H. atriplicis*, L., *Macrosiphum pisi*, Kalt., *M. ambrosiae*, Thomas, and *Brevicoryne brassicae*, L.

SATTERTHWAIT (A. F.). **How to Control Billbugs destructive to Cereal and Forage Crops.**—*Fmrs' Bull. U.S. Dept. Agric.*, no. 1003 (revd.), 22 pp., 25 figs. Washington, D.C., May 1932. [Recd. February 1933.]

This revised edition of a previous bulletin on the weevils of the genus *Sphenophorus* (*Calendra*) that attack cereals and cultivated grasses in the United States [*R.A.E.*, A, vii, 378] contains information on seven further species, of which *S. oblitus*, Lec., is probably the most important. It has caused damage of economic importance to maize over several areas and is capable of breeding on timothy grass [*Phleum pratense*]. Oviposition begins late in the summer, and under natural conditions in the laboratory the larval period occupied 5 months or longer. The Tachinid, *Myiophasia metallica*, Towns., is of some importance as a parasite of *S. parvulus*, Gyll., and *S. costicollis* var. *callosipennis*, Chitt. (lake-bank sedge billbug). An effective method of control for *S. maidis*, Chitt., and *S. callosus*, Ol., after the cold weather has rendered them inactive, is to plough the maize stubble, loosening the soil from the taproots by means of a spring harrow or other implement. The exposed insects should then be collected by hand.

[**Miscellaneous Circulars on Vegetable and Fruit Pests.**]—*Circ. N.Y. St. Agric. Expt. Sta.*, nos. 125–130, 6 nos., ill. Geneva, N.Y., 1932.

In Circulars 125–128 and 130 brief accounts are given of the bionomics and control of the Mexican bean beetle [*Epilachna corrupta*, Muls.], the potato flea-beetle [*Epitrix cucumeris*, Harr.], the squash borer [*Melittia satyriniformis*, Hb.], the potato Aphids [*Macrosiphum gei*, Koch, and *Myzus persicae*, Sulz.], and *Contarinia pyrivora*, Riley (pear midge) in New York. Circular 129 deals with the use of dormant oil sprays for the control of the pear psylla [*Psylla pyricola*, Först.].

ALDEN (C. H.). **Apple Insects and Diseases and how to control them.**—*Bull. Georgia St. Bd. Ent.*, no. 73, 32 pp., 14 figs. Atlanta, Ga., December 1930. [Recd. February 1933.]

An account is given of the chief pests and diseases of apple in Georgia, of which the former comprise *Cydia* (*Carpocapsa*) *pomonella*, L., which reduces the crop by an average of not less than 10 per cent. annually, *Aspidiotus perniciosus*, Comst., *Anuraphis roseus*, Baker, *Aphis pomi*, DeG., and *Eriosoma lanigerum*, Hausm. Minor pests are *Conotrachelus nenuphar*, Hbst. (plum curculio), *Cydia* (*Laspeyresia*) *molesta*, Busck, *Saperda candida*, F. (round-headed apple tree borer), *Chrysobothris femorata*, F. (flat-headed apple tree borer), and *Heliothis obsoleta*, F. (corn ear worm). The bionomics and control of each pest are briefly discussed, and a general scheme of remedial measures for application in apple orchards is outlined.

Third brood eggs of *Cydia pomonella* were found to be parasitised to the extent of 70·4 per cent. by *Trichogramma minutum*, Riley, which also attacked 22 per cent. of the early and 67 per cent. of the late brood eggs of *C. molesta* in 1930. Larval parasites of *C. pomonella* found naturally in Georgia are *Ascogaster carpocapsae*, Vier., and *Microdus* (*Bassus*) *carpocapsae*, Cush. *Macrocentrus ancylivora*, Roh., imported from New Jersey against *C. molesta* in 1930 was found to have parasitised 43 per cent. of the third brood larvae and 70 per cent. of the fourth brood larvae. Parasites of *Aspidiotus perniciosus* include *Aphelinus fuscipennis*, How., *A. mytilaspidis*, LeB., *Aspidiotiphagus citrinus*, Craw, and *Prospaltella aurantii*, How. *Chilocorus stigma*, Say (*bivulnerus*, Muls.) is an important predator that feeds on scale insects throughout the year. *A. perniciosus* is also attacked by the red-headed fungus (*Sphaerostilbe coccophila*) and by the black fungus (*Myriangium duriaei*). Natural enemies of apple Aphids include *Hippodamia convergens*, Guér., which feeds on both larval and adult stages, and the Syrphid, *Allograpta obliqua*, Say. Brief notes are given on the chemicals used as insecticides and fungicides in Georgia apple orchards.

ALDEN (C. H.) & CLARKE (W. H.). **The Life History and Control of the Oriental Fruit Moth.**—*Bull. Georgia St. Bd. Ent.*, no. 74, 23 pp., 6 figs., 4 refs. Atlanta, Ga., February 1931. [Recd. February 1933.]

All stages of *Cydia* (*Laspeyresia*) *molesta*, Busck, are briefly described, and a general account of its bionomics is given, with notes on the results of studies of its life-history in Georgia carried out in 1925 and 1926 [*R.A.E.*, A, xviii, 217] and again in 1930, when the average length of the life-cycle varied from 24·35 to 31·0 days. Parasites and

methods of control are discussed, much of the information having already been noticed. Clipping newly infested peach twigs has given moderately good control. It is suggested that packing houses should be screened to prevent the escape of any adults maturing from larvae accidentally taken into them.

DRIGGERS (B. F.). **Cocoon Parasites of the Oriental Fruit Moth.**—*J. N.Y. Ent. Soc.*, xl, no. 4, pp. 489–496, 9 refs. New York, December 1932.

Earlier investigations on parasites of the oriental fruit moth [*Cydia molesta*, Busck] have been chiefly concerned with those attacking the eggs or the larvae in twigs and fruit. Individuals in cocoons, however, are present in the field practically thoughout the year, and from the time of leaving the fruit until the cocoon is spun and throughout the larval, prepupal and pupal stages within the cocoon, *C. molesta* is particularly susceptible to parasite attack. The small increase in the numbers of the moth in the north of New Jersey, in view of the low parasitism of twig feeding larvae of the first brood compared with that recorded in the south, indicated the possibility of the stages within the cocoon being heavily attacked. Collections of the hibernacula from peach trees in the springs of 1928–30 revealed the presence of an undescribed species of *Ephialtes* (*Calliephialtes*) and *Aenoplex betulaecola*, Ashm., both of which probably confine their attack to the cocoon stage, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), *Pristomerus ocellatus*, Cush., which is known to attack a previous stage, and *Eurytoma* sp. and *Eupelmus* sp., which were apparently parasitic on *Glypta rufiscutellaris*, Cress. In view of the reduction in parasitism of the cocoons in three localities in 1929 compared with that in 1928 and the subsequent exceptionally severe damage to peaches (30–80 per cent. infestation being recorded on some varieties), a possible relation is suggested between the parasitism of the cocoon stages and the subsequent infestation of the fruit.

In order to determine the time at which parasitism of the hibernacula occurred, burlap bands were placed round trees in the late summer of 1928 and 1929, the hibernating larvae being removed from half of the bands twice a week and kept in the laboratory to await emergence, and the remainder being left undisturbed until the following spring. The data obtained showed that the larvae that had hibernated were parasitised to a considerably greater extent than those that had been collected shortly after leaving the fruit and beginning to construct their cocoons, and since the material came from the same source, the difference must be due to parasites that attack the cocoon stages. The small degree of parasitism found in the autumn was caused principally by two species of *Macrocentrus*, which are known to attack the feeding larvae. Several paralysed larvae of *C. molesta* were found under the bands in the autumn of 1929, to each of which was attached a minute larva ; one of these was reared and proved to be a species of *Aenoplex*.

DECKER (G. C.). **Biology of the Bidens Borer,** *Epiblema otiosana* **(Clemens) (Lepidoptera, Olethreutidae).**—*J. N.Y. Ent. Soc.*, xl, no. 4, pp. 503–509, 1 fig., 1 ref. New York, December 1932.

An account is given of observations in Iowa on the ecology, seasonal history and bionomics of *Epiblema otiosana*, Clem. (bidens borer)

[*R.A.E.*, A, xv, 397], which is indigenous to the eastern half of the United States. The young larvae feed in the buds, blossoms, seed heads and leaves of *Bidens* spp., and the older ones tunnel down within the main stem or one of the lateral branches, causing the top to wilt. A partial third generation occurs, and this reaches a peak in September.

This Tortricid constitutes an alternative host of the parasites of several species of economic importance, including *Papaipema nebris*, Gn., *Pyrausta nubilalis*, Hb., and *Macronoctua onusta*, Grote, 75–80 per cent. of its larvae in the field being sometimes attacked. The parasites reared from it were *Lixophaga variabilis*, Coq., *Muscina stabulans*, Fall., *Ceromasia* (*Masicera*) *senilis*, Mg., *Sarcophaga setulosa*, Wulp (*cimbicis*, Towns.), *Microdus* (*Bassus*) *simillimus*, Cress., *Pimpla* (*Epiurus*) *pterophori*, Ashm., *Microbracon caulicola*, Gah., *Apanteles harti*, Vier., *M. lutus*, Prov., and *Macrocentrus* sp.

KUNKEL (L. O.). **Insect Transmission of Peach Yellows.**—*Contr. Boyce Thompson Inst.*, v, no. 1, pp. 19–28, 3 figs., 4 refs. Yonkers, N.Y., 1933.

Experiments are described from which it is concluded that the Jassid, *Macropsis trimaculata*, Fitch, is a vector of yellows disease of peaches, 7 out of a total of 74 seedlings having contracted the disease as the result of the feeding of infected individuals. Brief notes are given on various other species, chiefly Homoptera, with which negative results were obtained. *M. trimaculata* was numerous on peach and plum in New York and New Jersey in 1931 and 1932, and has also been recorded from other States. It has one generation a year, the nymphs and adults, which feed chiefly on twigs and branches and appear to prefer old woody tissue, occurring over a relatively short period in summer. The eggs are dormant when deposited and apparently require low temperature for activation.

WILCOXON (F.) & HARTZELL (A.). **Some Factors affecting the Efficiency of Contact Insecticides. III. Further chemical and toxicological Studies of Pyrethrum.**—*Contr. Boyce Thompson Inst.*, v, no. 1, pp. 115–127, 4 figs., 14 refs. Yonkers, N.Y., 1933.

The following is largely taken from the authors' summary : Previous methods by which pyrethrins free from impurities have been obtained necessitate their conversion into a derivative and subsequent regeneration. In this paper a new method is described by which small quantities of the active principle may be isolated by a purely physical method, depending on the differential solubility of the pyrethrins and accompanying impurities in low boiling petroleum ether and 80 per cent. methyl alcohol. In the course of the work, samples differing widely in the ratio of pyrethrin I to pyrethrin II were obtained, and the former was proved to be considerably more toxic to *Aphis rumicis*, L., than the latter. Crude extracts of pyrethrum flowers were found to be slightly more toxic to the Aphid than highly purified extracts containing the same concentration of pyrethrin I ; possible explanations of this fact are suggested.

In view of the mortality resulting from the external application of pyrethrum under conditions that rendered tracheal penetration impossible [*R.A.E.*, A, xx, 323], the possible penetration of pyrethrins (the

volatility of which is low) through the integument was studied in various insects by means of dyes soluble in the pyrethrins. Penetration of the integument occurred in certain regions, and since the pyrethrins were proved to have a low but appreciable solubility in water, it appears probable that they dissolve in the body fluids and thus reach the nerve ganglia, causing the death of the insect. Observations carried out by means of a staining technique using toluidine blue revealed histological changes in the nerve ganglia that did not occur in individuals killed by decapitation or by nicotine sulphate or lead arsenate.

WALTHER (E.). **A Practical Method of Controlling** *Dendroctonus valens* **Lec.**—*Pan-Pacific Ent.*, ix, no. 1, p. 47. San Francisco, Calif., January 1933.

Ethylene dichloride, used instead of carbon bisulphide, proved effective in saving individual pines infested by *Dendroctonus valens*, Lec., in San Francisco. The outer bark was trimmed away and the liquid was injected into the burrows with a one-ounce medical syringe. The entrances, ventilating holes and all cracks were then stopped with putty to prevent the escape of the vapour, which was toxic to all stages of the beetle. Two years' experience has shown that this method gives over 95 per cent. control, without injuring the trees.

MCCLURE (H. E.). **The Effectiveness of the Sting of** *Aenoplex carpocapsae*, **Cushman (Hymen.: Ichneumonidae).**—*Ent. News*, xliv, no. 2, pp. 48–49. Philadelphia, Pa., February 1933.

Observations made in 1931 on the preservative quality of the sting of *Aenoplex carpocapsae*, Cush., on larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., in the cocoon showed that the paralysed larvae remained entirely fresh for an average period of 26 days, with a maximum of 73 days and a minimum of 41 hours, after which the process of gradual discoloration and death occupied an average period of 12½ days, with a maximum of 26 days and a minimum of 42 hours.

HOLDAWAY (F. G.). **An experimental Study of the Growth of Populations of the "Flour Beetle"** *Tribolium confusum* **Duval, as affected by atmospheric Moisture.**—*Ecol. Monogr.*, ii, no. 3, pp. 261–304, 11 figs., 5 pp. refs. Durham, North Carolina, July 1932. [Recd. February 1933.]

The following is the author's summary : The effect of atmospheric moisture on an insect, *Tribolium confusum*, Duv., has been studied from the point of view of its effect on a population in a unit environment. The effect of humidity on the physiology of the stages which constitute the population has also been studied and a comparison made of the evidence yielded from both lines of enquiry. As a result, the importance of population studies to problems in economic entomology has been stressed and the opinion expressed that physiological investigations on an economic insect should be carried out collateral to general population studies rather than as investigations confined to the purely physiological sphere.

Downes (W.). **The Cherry Fruit Worm and its Control in British Columbia.**—*Circ. Dept. Agric. Canada*, no. 79, 3 pp., 5 figs. Ottawa, February 1931. [Recd. February 1933.]

A brief account is given of the bionomics of *Cydia* (*Grapholitha*) *packardi*, Zell., which infests cherries in British Columbia [*R.A.E.*, A, xviii, 343]. It is chiefly injurious in Vancouver Island but also occurs in the lower Mainland and Okanagan districts. A spray recommended differs little from that already noticed [*loc. cit.*], the formula being 1 gal. summer oil emulsion, ½ pint nicotine sulphate (40 per cent.), ¾ lb. casein spreader and 50 gals. water. The spray should be applied within a week after the height of emergence of the moths, in order to destroy the maximum number of eggs.

Cushman (R. A.). **Aquatic Ichneumon-flies.**—*Canad. Ent.*, lxv, no. 1, p. 24. Orillia, January 1933.

Instances are recorded of parasitic Hymenoptera entering the water in order to attack their hosts. This habit is known in species of the genus *Agriotypus*, which walk down the surfaces of stones or plants in search of Trichoptera, and also in the genus *Trichocryptus*, the preferred hosts of which are the aquatic larvae of the Pyralid genus *Hydrocampa*. *Trichocryptus* and *Neostricklandia* are characterised by the body being covered by a fine, short, dense pile, evidently an adaption for association with water, and a similar covering on other Ichneumonids, such as *Amauromorpha metathoracica*, Ashm., a parasite of borers in rice, suggests the possibility of their being able to enter water in search of their hosts.

Smith (F. F.). **Biology and Control of the Black Vine Weevil.**—*Tech. Bull. U.S. Dept. Agric.*, no. 325, 45 pp., 16 figs., 56 refs. Washington, D.C., September 1932.

The following is almost entirely taken from the author's summary of the results of observations on *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., in nurseries and greenhouses in Pennsylvania, some of the information being similar to that already noticed [*R.A.E.*, A, xv, 256; xviii, 454].

This weevil damages crops in North America, Europe and Australia and is recorded as attacking 77 plants. The adults feed on the foliage at night; they also notch the petioles and girdle the shoots, which die above the point of girdling. The young larvae feed on the rootlets, and the older ones cut through the larger roots and hollow out the crowns of herbaceous plants or girdle the roots of woody ones. The larval injury is more severe than that caused by the adults. The eggs are not laid in any definite situation, but they are sometimes deposited in the soil or plant crevices. They hatch in 11–22 days. The larval stage lasts 72–113 days, though low temperatures may interrupt development during the winter. The prepupal period varies with the temperature from 21 days to 8½ months, and the pupal stage lasts 15–22 days. The adult remains 4–17 days in the pupal chamber in the soil before emerging, and the pre-oviposition period lasts 4–10 weeks.

Isolated adults in the greenhouse laid an average of 661·4 eggs in the first season and 375 in the second. The maximum adult life was 671 days. In the greenhouse, oviposition takes place during July and August ; the larvae mature from October to December, and the adults emerge from January to March. Out of doors, the adults emerge in June or July, oviposit during July and August, and enter hibernation in September, but only a few survive. These emerge in the following May and oviposit throughout the summer. Larvae from the first eggs laid out of doors spend the winter as prepupae, whereas those from the later ones hibernate before reaching maturity. The average number of eggs laid in the open in the first season was 216·1, but the number varied with the food-plant [xviii, 454]. No males were found during the course of these studies, reproduction being entirely parthenogenetic. The larvae were attacked by the larvae of a Carabid, an ant, *Formica* sp., and the fungi, *Isaria* sp. and *Fusarium* sp.

All infested plants should be removed from greenhouses before the emergence of the adults. If soil from such plants is to be used again, it should be sterilised by steam or by prolonged submersion in water; otherwise it should be dumped at some distance from the greenhouses. All food-plants growing in the open should be removed from the vicinity of the greenhouses or treated, and in the latter adhesive barriers should be placed on the benches or individual plants screened during July and August to prevent access of the adults to them. Lead arsenate mixed thoroughly with potting soil, at the rate of 1 or 2 oz. per bushel, killed the larvae as they burrowed in search of the roots. A dust of equal parts of calcium arsenate and lime gave 84–94 per cent. control of the adults when applied to the food-plant (yew) before oviposition began, but stained the foliage. Poison bran bait and poison apple bait applied on yew plants against the adults in early July did not harm the foliage, and gave 81–85 and 54–60 per cent. control respectively. The bran bait lodged on the needles and branches in much larger quantities than the apple bait ; the formula for it is 5 lb. bran, 1 U.S. pint molasses, 4 oz. calcium arsenate and 2 U.S. quarts water.

[Skalov (Yu. Yu.).] **Скалов (Ю. Ю.). On the Biology of** *Euxoa obesa* **B. (var.** *scytha* **Alph.) (Preliminary Report).** [*In Russian.*] —*Bull. St. Inst. Tobacco Invest., Crimean Sect.*, no. 79, 12 pp., 1 graph, 8 figs., 2 refs. Yalta, 1931. [Recd. February 1933.] (With a Summary in English.)

The Noctuid, *Euxoa obesa* var. *scytha*, Alph., is a serious pest of tobacco in the southern Crimea. The adults occur from the second half of August until early October and oviposit on the soil. The larvae hatch in 5–7 days and at first remain in groups on the surface under the shelter of rank growth of tobacco and weeds, on which they feed. Those of the third instar spread all over the plantation, sheltering in the soil by day and feeding at night. Hibernation occurs in the soil, and the larvae are particularly injurious to seedling tobacco in the spring. They aestivate in the ground from the end of May till August, when they pupate, the pupal stage lasting about a fortnight. Considerable numbers of the larvae are parasitised by *Apanteles congestus*, Nees, and *Meteorus rubens*, Nees. For control, clean cultivation is recommended, the soil being ploughed as soon as possible after harvest to expose the hibernating larvae.

[Skalov (Yu. Yu.).] **Скалов (Ю. Ю.). The Biological Cycle of the Tobacco Beetle** (*Lasioderma serricorne* **F.) under the Conditions of fermentative Factories and the Influence of Temperature Variations on the Activity of the Insect.** [*In Russian.*]—*Bull. St. Inst. Tobacco Invest., Crimean Sect.*, no. 80, 16 pp., 2 graphs, 1 fldg. chart, 7 refs. Yalta, 1931. [Recd. February 1933.] (With a Summary in English.)

Lasioderma serricorne, F., is an important pest of stored tobacco in the Russian Union, but is normally confined to the southern regions since frost and sudden fluctuations of temperature are detrimental to it. It may, however, do considerable damage in the northern districts if introduced into factories in which tobacco is fermented and conditions are favourable for its development. Observations showed that under conditions of temperature and humidity identical with those in the factory, development from egg to adult was completed in about the period necessary for complete fermentation of the tobacco (44 days), the egg stage averaging 5–7 days, the larval 31–39, the pupal 4–8, and the life of adults 11–23. The total number of eggs deposited by a female averaged 69·3, and was only very occasionally as high as 100. Oviposition usually took place several days after the emergence of the adults, sometimes only after 10–13 days. The percentage of adults that emerged during the period of the fermentation of the tobacco varied from 16 to 56.

Experiments in the control of *L. serricorne* by exposure of infested bales to high and low temperatures are described, and the following conclusions are drawn: All stages are killed within 24 hours at 48–50°C. [118·4–122°F.], or 72 hours at –5 to –10°C. [23–14°F.]. The process of fermentation and the quality of the tobacco are not affected by temperatures of 48–50°C., provided that the exposure is not too long and the atmospheric humidity is maintained at 60–70 per cent. The adult stage proved the least resistant one, beetles being killed in 24 hours at –9°C. [15·8°F.] and in 17 at 48–50°C. The pupae were killed in 24 hours at the high temperature and in 48 at the low one. At –5 to –9°C. the eggs were killed only after 3 days' exposure, and those subjected to fluctuations in temperature from –4 to 33°C. [24·8–91·4°F.] were unaffected and hatched at 25°C. [77°F.]. At 50°C. all eggs were killed in 16·5 hours, whereas at 48°C. only 50 per cent. were destroyed in 24 hours. The larvae proved most resistant to low temperatures ; an exposure of 6 days at –3 to –6°C. [26·6–21·2°F.] only reduced them to a state of torpor, from which they recovered at 25°C., and one of two days at –8°C. [17·6°F.] killed only 50 per cent. At 48°C. all larvae were killed in 24 hours.

In the regions in which *L. serricorne* normally occurs, the winter temperatures are seldom low enough to affect it appreciably. In the Sukhum district of Transcaucasia, however, it was reduced to negligible numbers by the very severe winter of 1929, when prolonged and unusual cold occurred in February, the temperature fluctuating between –0·4 and –9·3°C. [31·28 and 15·26°F.]

Bovien (P.). **Om Angreb af Haarmyglarver (Bibionidae) i Danmark.** [On Bibionid Infestation in Denmark.]—*Tidsskr. Planteavl*, xxxviii, pp. 488–498, 7 figs., 8 refs. Copenhagen, 1932.

The literature dealing with Bibionids occurring in Europe is briefly reviewed, and the species known to attack crops in Denmark, *Bibio*

hortulanus, L., *B. ferruginatus*, L., and *Dilophus febrilis*, L. (*vulgaris*, Mg.), are described. *B. ferruginatus* was recorded in Denmark for the first time as a pest in 1930, and no attack by Bibionids had been recorded there before 1916, when barley was severely infested by *B. hortulanus*. Notes are given on outbreaks in several localities in 1929, 1930 and 1931. *D. febrilis* was the most numerous species in infestations of grasses and clover in 1929 and 1931. In October 1930 observations were made on a severely infested crop of barley planted after rye. The Bibionids, although abundant on the barley, migrated for oviposition to a neighbouring field of rye, where the larvae were subsequently found in large numbers under leaves and refuse. This rye field was sown in 1931 with barley, but no attack of importance occurred in it, a large number of crows observed in the field having probably destroyed the greater number of the larvae. The larvae were collected and bred out in the laboratory, where they proved to be *B. hortulanus* and *B. ferruginatus*. Adults of the latter appear in the field in large numbers about 20th May and are not to be seen after 28th May, whereas *B. hortulanus* is still abundant on 6th June. This is confirmed by the laboratory observations, which showed that *B. hortulanus* may live until 5th June, whereas all adults of *B. ferruginatus* were dead by the end of May.

Larvae were brought into the laboratory in the autumn of 1931 in earth contained in pots 7 inches deep. During the first mild period of winter they rose to the surface, where they fed greedily on rye leaves or clods of manure. At the first sign of frost they returned to the earth. The larvae have been effectively destroyed by dusting the manure and leaves on the surface of the soil with various chemicals, including arsenicals and lime.

Bovien (P.). **Gulerodssnudebillen** (*Ceuthorrhynchidius terminatus* **Herbst.**). **Et for Danmark nyt Angreb.** [The Carrot Weevil, an Attack new to Denmark.]—*Gartner Tidende*, 1932, reprint 1 p., 2 figs. Copenhagen, 1932.

A brief account is given of a local infestation of carrots by *Ceuthorrhynchus* (*Ceuthorrhynchidius*) *terminatus*, Hbst., in June 1931 in Denmark, where this weevil had been known to occur only rarely on *Daucus maritima* and had never been recorded as attacking *D. carota*. A very large proportion of the plants was infested, the foliage being dwarfed and the necks of the carrots bored through. Some of the infested carrots were placed under glass in the laboratory, where adults became numerous at the end of July and the beginning of August, feeding in the leaves. The adults hibernate, ovipositing in the spring on carrots or possibly other umbelliferous plants.

[Vukasović (P.).] Voukassovitch (P.). **Contribution à l'étude des parasites et hyperparasites d'***Hyponomeuta malinellus* **Zell.**—*Rev. Zool. agric.*, xxxi, nos. 7–11, pp. 108–120, 124–136, 137–145, 153–160, 174–183, 2 pls., 5 graphs, 13 figs., 1 ref. Bordeaux, July-November 1932.

This paper, which deals with the biology of the parasites and hyperparasites of *Hyponomeuta malinellus*, Zell., in Serbia, and the anatomy of some of them, is a French version of the second of the three sections of a paper already noticed [*R.A.E.*, A, xx, 259].

Watzl (O.). **Wirksamkeit von Obstbaumkarbolineum.** [The Effectiveness of Fruit Tree Carbolineum.]—*Neuheiten PflSch.*, 1933, no. 1, pp. 1–6, 10 refs. Vienna, February 1933.

The object of this paper is to popularise in Austria a knowledge of the effectiveness of tar distillates for the control of orchard pests. A list is given of the chief pests against which they can be used, with brief notes on their bionomics and on the strength of the spray required.

Eckstein (K.). **Maikäferbekämpfung.** [Measures against May-beetles.]—*Forstl. WSchr. Silva*, xx, 1932, pp. 289–292. (Abstract in *Neuheiten PflSch.*, 1933, no. 1, p. 11. Vienna, February 1933.)

In the Westhavelland district of Germany enormous swarms of *Melolontha melolontha*, L. (*vulgaris*, F.) appeared on 13th May 1932 over a front of some 3 miles, the head-lights of cars being obscured by the beetles. Both *M. melolontha* and *M. hippocastani*, F., were observed migrating by night, sometimes for as much as about 2 miles. Ovipositing females were repelled by placing vessels containing tar distillate in vegetable plots and in plantations of young pines, but even better results were obtained with the Kaysing mixture, which consists of 75 gm. liquid vaseline (paraffin), 75 gm. pyrethrum powder and 850 gm. kerosene. A mixture of 4–5 gals. of this preparation with 1,000 lb. ground basic slag was strewn at the rate of 540 lb. per acre on the planted strips, the intermediate strips being sprayed with kerosene.

Takahashi (R.). **Aleyrodidae of Formosa. Part II.**—*Rep. Dept. Agric. Govt. Res. Inst. Formosa*, no. 60, pp. 1–24, 15 figs. Taihoku, Formosa, January 1933.

This paper contains notes on some little known Aleurodids in Formosa, with descriptions of 14 new ones and a list supplementary to the one already noticed [*R.A.E.*, A, xx, 352] of 35 wild and cultivated food-plants. Observations showed that the physical characters of leaves are an important factor in the selection of food-plants by some polyphagous species. *Trialeurodes ishigakiensis*, sp. n., is described from the lower surface of the leaves of mulberry (*Morus alba*) in the Loochoo Islands.

Takahashi (R.). **Observations on the Coccidae of Formosa. Part III.** *Rep. Dept. Agric. Govt. Res. Inst. Formosa*, no. 60, pp. 25–64, 16 figs. Taihoku, Formosa, January 1933.

This part of a series of papers dealing with the Coccids of Formosa contains a catalogue of the food-plants and a list of 33 species observed since the publication of the previous paper [*R.A.E.*, A, xviii, 706]. Notes are given on some little known species, with descriptions of 12 new ones, as well as of one from the Loochoo Islands.

Papers noticed by Title only.

Cummins (J. E.). **The Preservative Treatment of Fence Posts. (With Particular Reference to Western Australia.)**—*J. Dept. Agric. W. Aust.*, (2) ix, nos. 2–3, pp. 186–197, 394–408, 8 figs. Perth, W.A., June-September 1932. [See *R.A.E.*, A, xx, 270.]

STRICKLAND (A. G.). **Spray Residues on Fruit. Methods of Removal.**—*J. Dept. Agric. Vict.*, xxxi, pt. 1, pp. 18–21, 5 figs. Melbourne, January 1933. [*Cf. R.A.E.*, A, xx, 270.]

YOKOYAMA (K.). **New Tetranychid Mites attacking the Mulberry Leaf. Contribution I. Bionomics and external Structures of** *Tetranychus suginamensis* **n. sp.** [*In Japanese.*]—*Bull. Imp. Seric. Expt. Sta.*, viii, no. 6, pp. 229–287, 2 pls. Nakano, Tokyo, August 1932. (With a Summary in English.)

YOKOYAMA (K.). **Studies on the Dermestid Beetles of Japan. Contribution III. Bionomics and external Structures of** *Attagenus piceus* **Olivier.** [*In Japanese.*]—*Bull. Imp. Seric. Expt. Sta.*, viii, no. 6, pp. 289–336, 3 pls. Tokyo, August 1932. (With a Summary in English.)

KANDA (S.). **A new Species of the Genus** *Kermes* [*kuwanae*, sp. n., on *Quercus myrsinaefolia* in Japan].—*Annot. zool. jap.*, xiii, no. 5, pp. 551–557, 1 pl. Tokyo, 10th December 1932.

MENOZZI (C.). **Contributo alla conoscenza delle cocciniglie (Hemip. Coccidae) d'Italia (prima nota)** [including two new species].—*Boll. Soc. ent. ital.*, lxv, no. 2, pp. 41–47, 2 figs., 1 ref. Genoa, 28th February 1933.

LINDINGER (L.). **Beiträge zur Kenntnis der Schildläuse (Hem. Hom. Cocc.). Einige verschollene Schildlaus-Beschreibungen.** [On some overlooked Descriptions of Coccids.]—*Mitt. deuts. ent. Ges.*, iii, no. 8, pp. 125–126. Berlin, October 1932.

LINDINGER (L.). **Beiträge zur Kenntnis der Schildläuse. Hemiptera-Homoptera, Coccidae.** [Contributions to the Knowledge of Coccids (including changes in nomenclature).]—*Wiener ent. Ztg.*, xlix, no. 4, pp. 217–225. Vienna, 8th December 1932.

EGGERS (H.). **Borkenkäfer (Ipidae, Col.) aus Südamerika. V. Die Gattung** *Problechilus* **Eichh. mit 8 neuen Arten.** [Bark-beetles from South America. V. The Genus *Problechilus*, with 8 new Species.]—*Wiener ent. Ztg.*, xlix, no. 4, pp. 226–235. Vienna, 8th December 1932.

BREDO (H. J.). **L'invasion de sauterelles migratrices au Congo Belge.**—*Bull. agric. Congo belge*, xxiii, no. 1, pp. 70–91, 6 figs., 8 refs. Brussels, March 1932. [Recd. January 1933.] [*Cf. R.A.E.*, A, xix, 683 ; xx, 71 ; xxi, 155.]

PETTEY (F. W.). **New Species of South African Psyllids, III.**—*Ent. Mem. Dept. Agric. S. Afr.*, no. 8, pp. 3–23, 2 pls. Pretoria, 24th January 1933.

MUNRO (H. K.). **Records of South African Fruit-flies (Trypetidae, Diptera) with Descriptions of New Species.**—*Ent. Mem. Dept. Agric. S. Afr.*, no. 8, pp. 25–45, 1 fig., 1 pl. Pretoria, 24th January 1933.

MUNRO (H. K.). **Some Dacine and Ceratitine Trypetidae (Diptera) from Africa in the Collection of the American Museum of Natural History** [including new species].—*Amer. Mus. Nov.*, no. 597, 10 pp., 8 refs. New York, 25th February 1933.

BECK (D. E.). **Life History Notes and a Study of the Effects of Humidity on Adult Emergence of** *Rhagoletis suavis* **from Pupae at a Constant Temperature (Diptera, Trypetidae).**—*J. N.Y. Ent. Soc.*, xl, no. 4, pp. 497–499, 1 pl., 1 ref. New York, December 1932.

JONES (W. W.). **The Description and Biology of** *Nepticula braunella* **new Species (Lepidoptera-Nepticulidae), a Species of Leaf Miner on** *Prunus ilicifolia* **Walp. and the Variety** *integrifolia* **Sarg.** [in California].—*Univ. Calif. Pub. Ent.*, vi, no. 4, pp. 49–78, 10 figs., 85 refs. Berkeley, Calif., 1933.

VILLENEUVE DE JANTI (J.). **Description de** *Aplomyiopsis galerucellae* **n. gen., n. sp. (Tachinidae), parasite de** *Galerucella luteola* **(F. Müll.) en Amérique du Nord** [Oregon].—*Boll. Lab. Zool. Portici*, xxvii, pp. 125–126, 1 ref. Portici, 31st January 1933.

MILLER (F. W.). **Notes on several Species of Aphids collected on** *Populus angustifolia* **in Idaho.**—*Canad. Ent.*, lxv, no. 1, pp. 3–5, 3 refs. Orillia, January 1933.

PETCH (C. E.). **The Round-headed Apple-tree Borer** [*Saperda candida*, F.] **and its Control.**—*Circ. Dept. Agric. Canada*, no. 73, 4 pp., 3 figs. Ottawa, March 1930. [Recd. February 1933.] [*Cf. R.A.E.*, A, xii, 499 ; xvi, 501, etc.]

LIGHT(S. F.). **Termites of Western Mexico.**—*Univ. Calif. Pub. Ent.*, vi, no. 5, pp. 79–164, 5 pls., 33 figs., 34 refs. Berkeley, Calif., 1933.

MARCU (O.). **Ueber die Verbreitung und Blattschnittmethode von** *Deporaus tristis* **F. in der Bukowina und Moldau.** [The Distribution and Leaf-cutting Methods of *Rhynchites tristis* in Bukovina and Moldavia.]—*Zool. Anz.*, ci, no. 5–6, pp. 135–137, 2 refs. Leipzig, 2nd January 1933.

[REKACH (V. N.).] **Рекач (В. Н.). Studies on the Biology and Control of the Corn-seed Maggot** (*Chortophila* [*Phorbia*] *cilicrura* **Rond.**) [in Azerbaijan]. [*In Russian.*]—*Bull. appl. Botany, Genetics & Plant-breed.*, xxvi (1931), no. 5, pp. 267–285, 8 figs., 20 refs. Leningrad, 1931. (With a Summary in English.) [Recd. February 1933.] [See *R.A.E.*, A, xx, 349.]

[SOKOLOVSKAYA (R. E.).] **Соколовская (Р. Е.). Methods of determining the physical Properties of Insecticides and Fungicides** [a compilation from the literature]. [*In Russian.*]—*Bull. Leningrad Inst. Controll. Fm. For. Pests*, no. 3, pp. 283–293, 6 figs., 6 refs. Leningrad, 1932.

ZWÖLFER (W.). **Methoden zur Regulierung von Temperatur und Luftfeuchtigkeit.** [Methods for the Regulation of Temperature and atmospheric Humidity (a bridge-thermohygrostat).]—*Z. angew. Ent.*, xix, no. 4, pp. 497–513, 10 figs., 15 refs. Berlin, December 1932. [*Cf. R.A.E.*, A, xx, 328.]

SCHØYEN (T. H.). **Sprøiteforsøk mot paeregallmyggen og rognebaermøllet.** [Spraying Experiments with *Contarinia pyrivora* and *Argyresthia conjugella*.]—*Landbruksdirekt. Beret.* 1931, pp. C1–C14, 6 figs. Oslo, 1932.

Contarinia pyrivora, Riley (pear gall-midge), which was originally a native of Central Europe, began to assume importance as a pest about 70 years ago. In Norway, however, no attack was observed before 1912, and it was at first restricted to a narrow strip of land around Oslo fjord. Since then infestation has increased in severity and spread to the adjacent strip of Swedish coast and along the coast of the Skagerak as far as West-Agder. If *C. pyrivora* follows the coast northward again through Rogaland to Sogn and Fjordane, the pear-growers in these districts will be threatened with ruin unless they have been provided with effective means of control. Spread in a westerly direction, the adults being carried by the wind and the pupae and larvae in the roots of plants transplanted from the vicinity of infested trees, is merely a matter of time. Although there are great fluctuations in the severity of attack from year to year, once the gall-midge has gained a footing its vitality develops, and even a primary attack may result in the destruction of most of the fruit on infested trees. Early blooming varieties of pear are generally more severely attacked than those that bloom later, but annual variations in the date of emergence of the adults and in the blooming date of the different varieties may entirely reverse this. Oviposition takes place in the pear blossoms when they are about to open. The eggs are introduced into the midst of the petals and hatch after a few days, the larvae immediately beginning to feed on the fruit buds, stunting their development and often eating out the interior of the young fruit entirely. When fully-opened blossoms are attacked, the fruit is not completely destroyed but becomes deformed. In seasons when the oviposition period is prolonged, the percentage of such misshapen fruit is particularly high. The larvae, which drop to the ground and spin cocoons at a depth of 1–2 inches, and also the pupae, may be destroyed by cultivation of the soil to a depth of 3–4 inches. The earth should be finely broken up right up to the stem of the tree.

An account is given of a series of experiments in spraying and soil treatment for the control of *C. pyrivora* carried out from 1927 to 1931. Treatment of the soil in 1927–28 with calcium cyanamide at the rate of 22 lb. to 120 sq. yds. resulted in a crop of 55–64 lb. of fruit per tree as compared with 20–33 lb. from untreated trees. Applications of petroleum emulsion to the soil at the rate of 3 pints to 1 sq. yd. also gave fairly satisfactory results. An average increase of 23 lb. of fruit per tree was secured in 1930 from the application of 10 per cent. tar distillate. Spraying trees before the blossom opened to prevent oviposition failed to give satisfactory results. Spraying the blossom after it was fully opened with nicotine sulphate (1 : 800) or Paris green (1 lb. to 150 gals.) to destroy the newly-hatched larvae before they had time to penetrate the ovaries proved more successful. Trees sprayed with nicotine sulphate when about two-thirds of the blossom was open produced an average of 360 lb. of fruit, trees treated when the petals were about to fall producing 214 lb. The corresponding figures for trees treated with Paris green were 255 lb. and 140 lb. respectively, and the yield from untreated trees was 121 lb. The inferior result obtained with the later sprays suggests that many of the larvae had

already entered the ovaries by the time they were applied. The considerable quantity of fruit produced on the untreated trees was due to previous soil treatment. In 1931 the first application was made when two-thirds of the blossom on the south side of the trees was out, and the second a few days later when the same proportion of that on the north side was fully open, all trees being sprayed with nicotine sulphate each time. In two localities the yield was 130 and 143 lb. of fruit per tree as compared with 44 and 23 lb. from untreated trees. The smaller general yield was not due to a more severe attack by *C. pyrivora*, but to a lighter fruit set than in 1930. An average of $1\frac{1}{2}$ gals. spray was applied to each tree.

The control of *Argyresthia conjugella*, Zell. (apple fruit miner) is rendered difficult in orchards in Norway on account of their frequent proximity to forests from which the moths spread from their natural food-plants to apple [*cf. R.A.E.*, A, xvi, 235]. The practice of planting *Pyrus baccata* and *P. malus floribunda* as trap trees has proved useless as a control measure. *P. baccata* was practically free from attack in the midst of a severely infested orchard in 1931, and the experience of other workers has confirmed this immunity. The author believes spraying to be essential for the protection of apples from infestation. Good results were obtained in 1925 with lead arsenate sprays and with arsenical and sulphur dusts. The value of nicotine preparations was first shown in 1927 through work done in Sweden [*loc. cit.*]. In the neighbourhood of Oslo most of the eggs hatch in normal summers between 10th and 25th July, 30–33 days after they are laid. In the cold summer of 1931 the majority hatched about 5 days later in south-eastern Norway. As all the moths do not enter the orchard simultaneously, oviposition may extend over a considerable period. Nicotine sprays are most effective if applied on the last day before the eggs hatch. The Swedish experiments showed that the best control is obtained by two applications of the spray at an interval of 10–11 days, the results being entirely dependent on correct timing.

Laboratory tests showed that 40 per cent. nicotine sulphate will kill eggs just about to hatch or newly hatched larvae of *A. conjugella* even at a dilution of 1 : 800. The larvae are killed even if they have partly bored into the skin of the apple. With two sprays applied at the most favourable times the moth can be quite satisfactorily controlled in the orchard by means of a comparatively weak spray. With sprays at double strength (1 : 400), it is possible to kill 20-day old eggs, so that the use of stronger sprays allows a wider margin of time for making the applications. Details are given of the results of one or two applications of nicotine sulphate in various orchards in 1931, and they are compared with those obtained under similar conditions with lead arsenate. Two applications invariably secured a higher percentage of sound fruit, and nicotine sulphate consistently gave better results than lead arsenate, the increased return being more than double and so affording ample compensation for the higher cost of the former.

HENDEL (F.). **Ueber das Auftreten der in Schildläusen parasitisch lebenden Diptera-Gattung *Cryptochaetum* in Deutschland.** [On the Occurrence in Germany of the Dipterous Genus *Cryptochaetum* parasitic in Coccids.]—*Z. PflKrankh.*, xliii, no. 3, pp. 97–103, 3 figs. Stuttgart, 1933.

Cryptochaetum buccatum, sp. n., is described from *Palaeococcus* (*Monophlebus*) *fuscipennis*, Burm., in Germany, this being the first

record of this Agromyzid genus from that country. Information on parasitism of Coccids by other flies of the genus is given from the literature, with a key to the species.

SPEYER (W.). **Wanzen (Heteroptera) an Obstbäumen.** [Bugs on Fruit Trees.]—*Z. PflKrankh.*, xliii, no. 3, pp. 113–138, 4 pp. refs. Stuttgart, 1933.

An annotated list of Heteroptera found in bands on fruit trees or on the trees in summer in the orchard districts of the Lower Elbe is given as a supplement to a paper already noticed [*R.A.E.*, A, xx, 654]. *Pentatoma* (*Tropicoris*) *rufipes*, L., the only species definitely known to be injurious, was found both in the bands and on the trees.

STELLWAAG (F.). **Untersuchungen in Anschluss an die Beobachtung des Falterfluges bei** *Clysia ambiguella* **Hübn.** [Investigations connected with the Observation of the Flight-period of *C. ambiguella*.]—*Anz. Schädlingsk.*, ix, no. 2, pp. 17–23, 14 figs., 10 refs. Berlin, February 1933.

Detailed epidemiological data on the vine-moths, *Polychrosis botrana*, Schiff., and *Clysia ambiguella*, Hb., which are permanent pests in the Rhine Palatinate, have been obtained by systematic observations carried out since 1926. In this paper many points relating to *C. ambiguella* are discussed, some being based on facts ascertained by Sprengel [*R.A.E.*, A, xx, 50]. The meteorological factors found to influence flight were temperature and humidity. The adults flew among or slightly above the vine-stocks in the evening and morning twilight, at which time a humidity of 80–100 per cent. occurred between the vines and temperature was uniform. Even after a very hot day in August, 100 per cent. humidity was registered in this environment at about 2 a.m., the temperatures being 23·4°C. [74·12°F.] at 9.30 p.m., 21·6°C. [70·88°F.] at 11 p.m., and 18·6°C. [65·48°F.] at 5.30 a.m. Flight did not begin below 12°C. [53·6°F.] and ceased at 25°C. [77°F.]. The optimum lay between 18°C. and 20°C. [64·4–68°F.]. The optimum for longevity of the moths was between 16°C. and 22°C. [60·8–71·6°F.], and exposure to high temperature soon killed them. Low temperature prolonged life and interrupted the flight so that adults, eggs and larvae occurred together. A comparison of the vital optimum for oviposition, for female longevity, and for egg-development showed that it was most restricted for oviposition and least for egg-development.

ROEPKE (W.). **Zur Frage der Eichenblattminierer.** [On the Question of Oak Leaf-miners.]—*Anz. Schädlingsk.*, ix, no. 2, pp. 24–25, 3 figs. Berlin, February 1933.

Oak leaf-miners occurring in Holland are, in order of abundance, *Acrocercops* (*Coriscium*) *brongniardella*, F., an unidentified species, and *Tischeria complanella*, Hb., which is much the least common. *A. brongniardella* has two generations a year, the larvae living gregariously in the leaves.

ZIMMERMANN (A.). **Biologische Engerlingsbekämpfung.** [The Biological Control of Melolonthid Larvae.]—*Anz. Schädlingsk.*, ix, no. 2, pp. 26–27, 2 figs. Berlin, February 1933.

With reference to a statement that in Poland the cultivation of buckwheat has prevented infestation of pines by Melolonthid larvae [*R.A.E.*, A, xx, 494], the author considers that the intensive cultivation of the ground previous to planting the buckwheat was the true reason, as this crop is quite as liable to attack as any other. An instance of infestation of it is described from Holstein. The growing of lupins also fails to prevent infestation, but the author has kept his garden free from Melolonthid larvae by allowing self-sown poppies to grow among other plants until they begin to choke them. Poppy seed mixed with sand can be sown, preferably in wet weather in autumn or spring, in places where pines are to be planted. Ovipositing Melolonthids avoid such ground, and the larvae die if they feed on the roots.

MACDOUGALL (R. S.). **Insect and Other Enemies in 1931.**—*Trans. Highl. Agric. Soc. Scotland*, 1932, reprint 23 pp., 6 figs., 6 refs. Edinburgh, 1932.

Instances are recorded of larvae of *Athetis clavipalpis*, Scop. (*Caradrina quadripunctata*, F.) causing annoyance in houses and shops, having migrated from warehouses, etc., to which they had been carried at harvest with hay, wheat and peas, on which they feed. In one case large numbers were destroyed by ringing round infested haystacks with sawdust soaked in a disinfectant. The capture of *Lepisma saccharina*, L. (silverfish) for purposes of examination was facilitated by surrounding the object under which the insects were sheltering with drops of water, in which they were caught. Frequent dusting with pyrethrum powder is recommended for their control, other measures having already been noticed [*R.A.E.*, A, xix, 577, etc.]. *Tachycines asynamorus*, Adel. (greenhouse grasshopper) was received from mildly heated greenhouses containing cucumbers and tomatos. Individuals were observed in stacks of turf in the open, but owing to their susceptibility to cold, they are more usually found sheltering under boxes and in well heated greenhouses. They are nocturnal in habit and considerable numbers have been collected at night, though without effecting any appreciable control.

The Common Furniture Beetle.—*Leafl. For. Prod. Res. Lab.*, no 8, 5 pp., 2 pls., 1 fig., 6 refs. Princes Risborough, Bucks, 1933.

Notes are given on the bionomics and control of *Anobium punctatum*, DeG. [*cf.* *R.A.E.*, A, xvi, 185, etc.], the egg and adult being briefly described. In experiments under indoor conditions in England, it was found that in no case was the life-cycle of this beetle completed in less than two years [xix, 72]. It is often possible to eradicate it from infested unpolished furniture by working kerosene or turpentine well into the wood with a brush. Several proprietary insecticides are said to cause no damage to polished or varnished surfaces ; those containing dichlorobenzene, chlorinated naphthalenes or colourless creosote derivatives are among the most effective. Insecticides should be applied especially to cracks, crevices, and joints, the undersides of

chairs, backs of drawers, etc., where varnish or polish is absent and where the eggs are generally laid. High grade creosote oil is recommended for structural timbers, and should be applied after the removal of as much powdered wood as possible. Insecticides are most effectively applied during late spring and early summer when the pupating larvae and young beetles are near the surface. Treatment should be repeated at intervals during this period and for at least two years in succession. For the prevention of attack in furniture, the use of well-seasoned timber, free from sapwood, and the provision of sound joints are desirable.

COTTIER (W.). **A Study of the Insect Fauna of Swede Turnips infected with Dry-Rot.**—*N. Z. J. Sci. Tech.*, xiv, no. 3, pp. 142–145, 2 refs. Wellington, N.Z., December 1932.

A study was undertaken in New Zealand in 1930–31 on the succession of insects and mites attacking swedes infested with dry rot (*Phoma lingam*), as a preliminary to experiments on the transmission of the disease by them [*R.A.E.*, A, xxi, 30, etc.]. The insects listed include many that are recorded for the first time from New Zealand and three undescribed Staphylinids. *Drosophila rubrostriata*, Beck., and the Staphylinid, *Atheta pseudocoriaria*, Bernh., were selected for further study, since they were the most abundant from February to April, the most important period in the spread of the disease, and come first and second in the succession of insects associated with the lesions it causes. In the laboratory the larval stage of *Atheta* occupied approximately 6 weeks and the pupal period about 10 days, the latter being passed in an earthen cell in the soil. A total of 219 beetles increased to at least 384 and 6 to 130 in about 6 months. The life-cycle of *D. rubrostriata* from egg to adult requires about 5–6 weeks, this being the average time elapsing between the peak of emergence of successive generations in the greenhouse. It is very prolific. It appears probable that hibernation occurs in the pupal stage in the soil. The larvae do not appear to penetrate deeply into their food material, and the pupae are always exposed on the outside of it, in more or less regular rows.

CORBETT (G. H.). **Some Preliminary Observations on the Coffee Berry Beetle Borer** *Stephanoderes* (*Cryphalus*) *hampei* **Ferr.**—*Malayan Agric. J.*, xxi, no. 1, pp. 8–22, 1 pl. Kuala Lumpur, January 1933.

The Scolytid, *Stephanoderes* (*Cryphalus*) *hampei*, Ferr., was first discovered in Malaya in 1929 and has since been found to be generally distributed, but is not yet present in all the coffee areas. The beetles feed on the green berries and breed in the ripe ones. A fungus may attack bored unripe berries, causing them to turn black and in many cases to drop to the ground. An infestation of 50 per cent. of ripe berries was found to result in a reduction of 26 per cent. in the yield of beans.

All stages and observations on the habits of the adults are described. The proportion of male to female pupae was 1 : 13. Oviposition began 4–14 days after emergence from the pupa and continued throughout the life of the female, which may last as long as 4 months. The

maximum number of eggs laid by an individual was 60. The incubation period occupied 5–7 days, the larval stage 12–20 and the pupal 4–7. The berries of the robusta type were most susceptible to attack between the ages of 6 and 9 months; the ripe berries were most heavily infested, the large black berries on the bush contained all stages of the beetle and the fallen black berries the greatest number of adults. Berries of the Liberian type, which have a larger proportion of pulp to beans, were less liable to attack.

When new areas are to be opened up, isolated infested bushes in the neighbourhood should be destroyed or kept free from berries for six months, all fallen berries being collected. All seeds intended for planting should be fumigated. Hydrocyanic acid gas and carbon bisulphide have proved successful fumigants, but are difficult to procure and use and are liable to affect the germination of the seed. Turpentine was found to be both simple and effective, and the method of fumigating with it, which is similar to that used in Java [*R.A.E.*, A, xix, 193], is fully described.

Experiments with weekly, fortnightly, three-weekly and monthly collections from bushes in a heavily infested area of all ripe, bored green and black berries showed that 90, 79, 76 and 66 per cent. respectively of the ripe berries remained uninfested as compared with only 11 per cent. of those from the controls, from which only the ripe berries were collected. Other observations are described that indicate the great desirability of weekly collections of all ripe, bored green and black berries both on the bush and on the ground.

A growth of weeds and cover crops should not be permitted, since they hinder the collection of fallen fruit. Bags should be substituted for baskets to prevent the escape of the beetle after collection and should only be partly filled. They should then be placed in boiling water for $1\frac{1}{2}$–3 mins. and subsequently submerged for 4 days. This operation does not affect the quality of sound beans in the berries. If it is delayed, the berries should be stored in receptacles to prevent the escape of the beetles. Most of the beetles leave the berries between 3.30 and 4.30 p.m. and the latter should be disturbed as little as possible during this period. The factories should be kept free from rubbish in which breeding might take place. The introduction of a "dead" season of six months during which the plantation is kept free of all berries, as is possible in Java [*cf.* x, 506] where there is a dry season during which few berries are produced, would involve a considerable reduction in crop, and there would still be an ultimate risk of re-infestation. It is therefore only recommended in isolated areas or where co-operation among the growers can be obtained.

Corbett (G. H.). **Entomological Notes. Fourth Quarter, 1932.**—*Malayan Agric. J.*, xxi, no. 1, pp. 35–37, 1 pl. Kuala Lumpur, January 1933.

The possibilities of using arsenical dusts and sprays against leaf-eating caterpillars on coconut in Malaya are discussed. Preliminary experiments with dusts showed that they are less effective than sprays, and though they can be applied more easily under local conditions, they cannot be recommended until more detailed experiments have been carried out.

Lever (R. A.). **Annual Report for the Year 1931–32, Department of Entomology, British Solomon Islands Protectorate.**—Folio 8 pp. typescript.

The premature fall of coconuts from soon after they are fertilised until they are half grown constitutes a serious problem in the Solomon Islands, particularly as no other crop is grown. In estimating the part played by insects, it is necessary to distinguish between nuts falling through their agency and those representing the normal shedding of two-thirds of the crop. The Pentatomid, *Axiagastus cambelli*, Dist., and the Pyralid, *Tirathaba rufivena*, Wlk., are responsible for an appreciable fall. The latter occurs from Ceylon, throughout the Netherlands Indies and Melanesia into Queensland and is closely allied to *T. trichogramma*, Meyr., which is present in Fiji, Wallis Island, Tonga and Samoa. Though now numerous and widely distributed, it was not even mentioned in a recent survey of the Solomon Islands [*R.A.E.*, A, xvii, 416]. The larvae attack preferably the male flowers, but the potential nuts are also infested, especially when a dark situation favourable to oviposition is provided by the failure of the spathe to burst cleanly. A high percentage of nuts may also be attacked on palms that produce few male flowers but have many young nuts in contact along the spadix, and also on those on which the leaves come off at a sufficiently acute angle to prevent the spadices from spreading fully. The fall of the nuts is caused by the larvae boring through the side or more rarely through the stigma, or in the case of the older ones, by one or more larvae congregating beneath the calyx. *Apanteles tirathabae*, Wlkn., has been reared from the earlier instars of the larvae from coconut and the swamp palm (*Nipa fruticans*), which appears to be a new food-plant [*cf.* xx, 722]. *Calliceras* sp. is a hyperparasite on this Braconid, at least 9 individuals developing on a single host, the life-cycle of which occupies 15–17 days.

In addition to causing the drop of young nuts, *Axiagastus cambelli* causes slits in the skin during feeding, rendering the fruits warped and misshapen. Its egg parasites [xvii, 417], which have been determined as a Eupelmid, *Anastatus* sp., and a Scelionid, *Microphanurus* sp., are apparently present throughout the Protectorate, though of distinctly local distribution. It has been found on the inflorescence of the wild betel palm (*Areca* sp.), which is probably the usual food-plant in the interior of the large islands where coconut is only found in isolated hill villages.

Other pests of coconuts, additional to those already mentioned [xx, 433, 660, 722], are the Dynastids, *Trichogomphus semilinki*, Ritz. (Solomon Islands rhinoceros beetle) and *Xylotrupes gideon*, L. (elephant beetle), which cause some damage to the young spadices and central shoots, the pupae being found in rotten coconut trunks; the Cetoniids, *Ischiopsopha wallacei*, Thoms., and *Panglaphyra duboulayi*, Thoms., which attack the male flowers but are probably of use in cross pollination; and the weevils, *Diocalandra taitensis*, Guér., and *D. frumenti*, F., which intensify any injury but do not appear to be primary pests.

Oecophylla smaragdina, F., is predatory on *Axiagastus cambelli*, but has occasionally been found to foster mealybugs on the calyx of the young nuts. Attempts to distribute it through plantations were unsuccessful owing to the activity of *Iridomyrmex myrmecodiae*, Emery, in the eastern islands and *Pheidole* (?) *oceanica*, Mayr, in the western ones. The Indian mynah bird (*Acridotheres tristis*) destroys the larvae of *Tirathaba rufivena*. Attempts to carry out mass-breeding

of the two local parasites of *Axiagastus cambelli* did not yield good results, and it was found more satisfactory to rear them from material collected from the field. Efforts are also being made to increase artificially the parasitism of *T. rufivena* by *Apanteles*.

Leefmans (S.). **Ziekten en plagen der cultuurgewassen in Nederlandsch Oost-Indië in 1930.** [Diseases and Pests of cultivated Plants in the Netherlands Indies in 1930.]—*Meded. Inst. PlZiekt.*, no. 81, 84 pp. Buitenzorg, 1933.

Many of the pests here recorded have been mentioned in previous reports [*R.A.E.*, A, xix, 397, etc.]. Others include the Limacodid, *Thosea asigna*, van Eecke, on oil palm [*Elaeis guineënsis*]; the Tingid, *Elasmognathus hewitti*, Dist., and the weevil, *Lophobaris piperis*, Mshl., on pepper [*Piper*]; *Nezara viridula*, L., and *Riptortus linearis*, F., on soy-beans [*Glycine hispida*]; *Aleurodicus destructor*, Mackie, on coconut; *Lophococcus convexus*, Morr., on *Derris microphylla*; *Tarsonemus translucens*, Green, on seedling rubber [*Hevea*]; and the Psychid, *Clania variegata*, Sn., on coffee. The predacious Carabid, *Calosoma sycophanta*, L., imported into Java against Lepidopterous pests [*cf.* xix, 163], has been bred and liberated in a plantation of *Cinchona*.

Hart (P. C.). **De topboorderschade in het suikerriet.** [Tip-borer Injury in Sugar Cane.]—*Arch. Suikerind. Ned. Indie*, 1933, pp. 47–71; also as *Meded. Proefst. Java-Suikerind.*, 1933, no. 3. Pasoeroean, 1933.

In order to be able to estimate the probable value of control measures against *Scirpophaga intacta*, Sn., on sugar-cane, experiments were carried out in Java to ascertain the amount of damage on the basis of crop yield in lightly and severely infested plots. The percentages of infestation averaged 18·6 and 52·7, and the yield was 14 per cent. higher in the lightly infested plots.

Koolhaas (D. R.). **The Analysis of Derris Roots and the Estimation of the Rotenone Content.**—*Bull. Jard. bot.*, (3) xii, no. 3–4, pp 563–574, 14 refs. Buitenzorg, December 1932.

The following is taken from the author's summary. The rotenone content of derris root shows wide variation even in the case of different plants of a single variety. It does not always show a maximum for derris roots at the age of 23–24 months [*cf. R.A.E.*, A, xviii, 655]. It is lower for very fine than for coarse ones. The rotenone chiefly occurs in the wood. There is no relation between the rotenone content and the ether extract [*cf.* xix, 365]. An improved method of estimating the rotenone content of derris is given.

The Potato Beetle (A Serious Pest of the Potato Crop).—*Circ. Dept. Agric. Mysore*, no. 49, 4 pp., 1 pl., 1 fig. Bangalore, 1932.
Krishnamurti (B.). **The Potato Epilachna Beetle,** *Epilachna vigintioctopunctata* **(Fabr.).**—*Bull. Dept. Agric. Mysore*, Ent. Ser., no. 9, 16 pp., 5 pls. Bangalore, 1932. [Recd. March 1933.]

The first paper is a short account of the information given in the second on *Epilachna vigintioctopunctata*, F., which is widely distributed in Mysore and prevalent in the potato growing areas. Its food-plants

include egg-plant (*Solanum melongena*), various cultivated cucurbits and a few wild solanaceous plants, but potato is always preferred. In Mysore two crops of potatoes are usually grown, from December or January to April and from May or June to September; during the intervening periods the beetles migrate to other food-plants. The adults and larvae eat all the fleshy tissues of the leaves; the shoots and remains of leaves turn brown and die, and in most cases tuber formation is hindered or prevented. The adult male lives for about two weeks and may pair with more than one female. During the life of a female, which lasts not less than 3–4 weeks, 120–150 eggs may be deposited; these are laid in clusters on the lower surface of the leaves and hatch in 2–4 days. The larval stage lasts 4 or 5 weeks, the prepupal stage about 3 days and the pupal stage 3–5 days. The adults, which can fly for distances of up to ½ mile, are widely dispersed by the prevailing strong winds. The larvae are attacked by a Chalcidoid parasite, as many as 45 individuals of which have been obtained from one host, but the percentage of parasitism has never exceeded 5–8. The Eulophid, *Tetrastichus ovulorum*, Ferrière, parasitises a small percentage of eggs 1–2 days old, laying not more than 3 eggs in each. Unsuccessful attempts were made to rear it in sufficient numbers to use for control; its life-cycle required 6–10 days.

The measures suggested include hand-picking, which is only effective in small areas and before the infestation has become severe, and the destruction of all wild food-plants in the vicinity of potato fields. Of a number of insecticides tested [*cf. R.A.E.*, A, xxi, 28], the most effective was a spray of 1 lb. lead arsenate in 50–60 gals. water, with 5 lb. lime and 10 lb. jaggery, which gave over 90 per cent. control. All plants in the crop were sprayed 20–30 days after planting, special attention being given to the lower surface of the leaves. A second spray may be applied more lightly 3–4 weeks later to kill any beetles that migrate from unsprayed areas. In cases of severe infestation, a thorough spraying as late as 1½–2 months after planting has given good results. From 4–6 lb. lead arsenate are required to spray 1 acre, the amount varying with the extent of infestation, the number of sprays, and the time of application.

MAYNE (W. W.). **Annual Report of the Coffee Scientific Officer, 1931–32.**—*Bull. Mysore Coffee Expt. Sta.*, no. 7, 32 pp. Bangalore, 1932. [Recd. March 1933.]

This report includes (pp. 24–29) a brief account of the work begun in 1931 in southern Coorg on a mealybug (? *Pseudococcus citri*, Risso) and Lamellicorn larvae attacking coffee.

The mealybug, which is ubiquitous in this area, was not a serious pest in July 1931, but towards the end of the survey heavily infested coffee plants were seen. It sucks the roots, at the same time stimulating callus growth and becoming partly enclosed by it. The points of injury provide entrance for putrefying organisms. Young plants with well developed root-systems do not seem to suffer seriously. During the life of a female 350–650 eggs are laid in masses surrounded by meal. The female moves a short distance away to make room for the next batch of eggs. The incubation period is 2–4 days, and the mealybugs become active and search for food 2–3 days after hatching. They are widely distributed in the soil to a depth of one foot and occur freely on the roots and underside of loppings of *Erythrina*. Occasionally

adults are found on the stems of *Erythrina*, but they are of no economic importance, since they have ceased to lay eggs. This mealybug can become accustomed to the aerial parts of the plants if it is kept in the dark. Two species of ants and an unidentified beetle are associated with it.

Preliminary observations carried out in July 1931 indicate that Lamellicorn larvae were probably not responsible for the damage to coffee roots formerly attributed to them. The movements of the larvae in a box of soil were determined by its water content. The first adult beetles, of which there were two species, were seen on 9th March, and their numbers began to increase a week later. Light traps proved ineffective for catching them.

SUMMERVILLE (W. A. T.). **Notes on the Onion Thrips.**—*Queensland Agric. J.*, xxxix, pt. 1, pp. 41–46. Brisbane, January 1933.

Notes are given on the habits of *Thrips tabaci*, Lind., attacking onions in Queensland. One variety of onion seems to be less susceptible than others. The main injury is caused by the adults, which tear away the surface tissues of the older leaves and suck the juices, causing white blotches and streaks, and withered tips when infestation is severe. Various contact insecticides were tried against the adults in a recent heavy outbreak, the best results being obtained with Katakilla used at recommended strengths. Counts 24 hours after spraying showed an average of 1·9 thrips per leaf on sprayed plants and 8·7 on unsprayed. The whole plant should be thoroughly wetted and the ground near it should be slightly sprayed. Two sprays should usually be sufficient.

THOMAS (P. H.) & RAPHAEL (T. D.). **Red Spider. Further Control Experiments.**—*Tasmanian J. Agric.*, (N.S.) iv, no. 1, pp. 4–9, 4 figs. Tasmania, 1st February 1933.

Following a warm, dry summer *Tetranychus telarius*, L., and *Bryobia praetiosa*, Koch, were very numerous on fruit trees in Tasmania in the autumn of 1932. It is probable that the latter mite can best be controlled by sprays applied against the winter eggs or newly hatched larvae during the period from July to October. Various proprietary sprays were therefore tested at recommended strengths during this period. Pieces of apple branches eighteen inches long were taken from badly infested trees, immersed in the spray solutions and then kept in water in the laboratory. This method gave 100 per cent. cover as opposed to about 90 per cent. in the field. The first mites hatched in September, both in the field and in the laboratory, but hatching was more rapid in the latter. The best results were obtained with two dormant oil emulsions, which gave 100 per cent. control; although vegetative growth was delayed by them for 2 or 3 weeks it was healthy. Lime-sulphur (1 : 12) was ineffective. Subsequent tests showed that late winter sprays had no greater ovicidal value than early ones, but they also eliminated the first hatched mites. Atmospheric conditions did not affect the potency of the sprays on twigs kept in the open, although rain washed off and drowned many mites.

Another experiment showed that reinfestation of sprayed trees from unsprayed prunings can take place; the sprays should therefore be applied before pruning.

NICHOLLS (H. M.). **The Oak Scale and its Parasite.**—*Tasmanian J. Agric.*, (N.S.) iv, no. 1, pp. 24–26, 1 fig. Tasmania, 1st February 1933.

Brief descriptions are given of *Asterolecanium variolosum*, Ratz. (golden oak scale) and its Encyrtid parasite, *Habrolepis dalmani*, Westw. *A. variolosum*, which is of European origin, now occurs on oaks throughout Tasmania, and has caused serious injury to them in some localities. *H. dalmani*, which has been successfully established in New Zealand for its control [*cf. R.A.E.*, A, xiv, 421], has now been introduced into Tasmania from that country and liberated on infested trees in two localities.

WATANABE (C.). **Notes on Braconidae of Japan. III.** *Apanteles.*—*Insecta matsum.*, vii, no. 1–2, pp. 74–102, 1 pl., 6 figs. Sapporo, December 1932.

A list is given of the species of *Apanteles* of the Japanese Empire, with their synonymy, hosts and a key. Among the new species described is *A. igae* bred from a larva of *Tinea pellionella*, L., in Tokyo. *A. dendrolimi*, Mats. [*R.A.E.*, A, xiv, 385] is considered to be a synonym of *A. ordinarius*, Ratz., and *A. posticae*, Sonan [xvi, 483] and *A. japonicus*, Ashm. [xviii, 33 ; xx, 653] of *A. liparidis*, Bch.

SHIBATA (K.). **Experimental Studies on the Influence of Low Temperatures upon the Development of the Paddy-borer** (*Schoenobius incertellus* **Wlk.**). **First Report.** [*In Japanese.*]—*J. Soc. Trop. Agric.*, iv, no. 4, pp. 504–516, 14 refs. Formosa, December 1932. (With a Summary in English.)

To determine experimentally the northern limit of distribution of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), one of the most serious pests of rice in Japanese territory [*cf. R.A.E.*, A, xx, 274, 380], the resistance of the insect to cold was examined. The cold hardiness of the larvae was slightly higher than that of the pupae. Curves are given showing the minimum time required to kill all the larvae and pupae at temperatures ranging from —12°C. [10·4°F.] to 0°C. [32°F.].

METCALFE (M. E.). *Dasyneura leguminicola* **(Lint.), the Clover Seed Midge.**—*Ann. Appl. Biol.*, xx, no. 1, pp. 185–204, 1 pl., 2 diagr., 36 refs. London, February 1933.

Two Cecidomyiids are stated to attack the flower heads of red clover (*Trifolium pratense*), one (*Dasyneura leguminicola*, Lint.) in America, the other (*D. flosculorum*, Kieff.) in Europe. Both have been recorded in Britain, the former as a serious pest since 1926 [*R.A.E.*, A, xiv, 401]. Successful cross-breeding experiments with material obtained from New York and Ontario are described, showing that the midge occurring in the South of England is *D. leguminicola*. It is not, however, certain whether *D. flosculorum* is distinct from it. All stages of the former are described. Studies of its bionomics in England in 1931–32 show them to be in general similar to those already recorded in the United States [xviii, 13]. Material of the overwintered brood was collected by washing out cocoons in March from soil adhering to clover roots, and of the summer brood by gathering infested heads in late June shortly before pupation. For the cross-breeding experiments, immunity trials

and life-history observations, clover plants growing in pots were covered with muslin before the flower heads appeared. At the green-head stage, midges were introduced and the heads examined periodically for eggs and larvae. The full-grown larvae were washed out by spraying and kept for pupation on sand or damp fibre. The maximum emergence of midges of the overwintered brood occurred between 28th May and 4th June, and of the summer brood in the first week of August. Mating took place soon after emergence, and oviposition from 3 hours to 2 days later. The egg stage lasted 2–6 days. Four larval instars were distinguished, of which the first three occupied 10–14 days; the fourth may last as long as 7 weeks, though in some cases larvae entered the soil 15 days after the eggs were laid. Pupation of the summer brood took place from a few days to a fortnight after the larvae had entered the soil. Second-brood larvae overwintered in the cocoon and began to pupate the following May.

A list is given of the parasites of *D. leguminicola* recorded in the United States. Two Hymenoptera (one identified as the Eulophid, *Tetrastichus roesellae*, Nees) were observed. The percentage of parasitism varied from 16 to 47, the higher proportion occurring when the maximum emergence of the parasites preceded that of the midge, the lower when it followed. In a series of immunity tests, white clover (*Trifolium repens*) was not attacked. Of red clover (*T. pratense*), the varieties most attacked were those of which the maximum green-head stage coincided with the maximum emergence of the midges. It is suggested that, unless an immune variety can be produced, varieties should be selected for seed-production that are in the green-head stage either before or after this period.

For control it is suggested that the first crop should be cut early so that the young first-brood larvae in the flower heads are killed with the drying of the hay. The cutting should be done within 10 days at most of the emergence of the overwintered brood midges, as soon as the attacked heads can be detected in the field. These are recognisable by their uneven blooming or the total suppression of corollas and are harder to the touch than normal heads. It is not advisable to leave the cut crop lying in the field even in dry weather, as, even if the larvae are not fully developed, some of them may drop to the ground and pupate. Other measures that have been recommended in the literature include pasturing, destruction of self-sown clover, and killing larvae and pupae within the seed by heat or fumigants.

MILES (H. W.). **Dusting for the Control of Apple Sawfly: A preliminary Experiment.**—*J. Minist. Agric.*, xxxix, no. 12, pp. 1125–1128, 4 pls. London, March 1933.

A brief account is given of the bionomics of *Hoplocampa testudinea*, Klug (apple sawfly) in England [*R.A.E.*, A, xx, 579]. Good control has been obtained with nicotine sprays accurately timed by the flowering of the apples to kill the newly hatched larvae [*cf.* also xvii, 255; xx, 550], but in plantations of mixed varieties, in which the females have been found to be present for about two weeks, the flowering period varies. Tests were therefore made in 1932 with a proprietary dust containing 30 per cent. pure naphthalene, used as a repellent against the adults. The apple trees were of the bush type, 8–9 ft. high, and 3 lb. of dust was used for 20. Alternate blocks of 3 trees were treated and left as controls. Applications were made on 24th May (when 10–20 per cent. of the flowers were open), 28th May, and 3rd and

6th June; on the final date only 10–20 per cent. of the flowers remained. The dust did not affect fruit setting, and examinations on 6th June and 6th July showed 12 and 25 per cent. infestation on untreated trees and 2 and 7 per cent. on treated ones. It is thought that the dust was of even greater value than is indicated, as the odour permeated through the plantation and appeared to reduce infestation on the untreated trees. Other varieties at a greater distance showed 30–40 per cent. infestation. Several light dustings should be undertaken, because the fine dust volatilises quickly and does not last throughout the flowering period.

HUKKINEN (Y.). **Maatalouskoelaitoksen Tuhoeläinosaston toimintakertomus v. 1927.** [Report of the Department of Injurious Animals for 1927.]—*Maatalouden koetoiminnan keskusvaliokunnan vuosikertomus 1927* [Ann. Rep. Centr. Bd. Agric. Res. 1927], pp. 31–37. Helsingfors, 1932. [Recd. April 1933.]

Satisfactory results were obtained in experiments in Finland with arsenical dusts against *Phaedon cochleariae*, F., *Blitophaga opaca*, L., and larvae of *Charaeas graminis*, L., and with adhesive bands against *Cheimatobia brumata*, L. Preliminary tests with poison baits in the control of *Pegomyia hyoscyami*, Panz., were promising. Other pests studied included *Oligotrophus alopecuri*, Reut., and Thysanoptera.

VAPPULA (N. A.). **Peltokasvien tuholaiset v. 1931.** [Field Crop Pests in Finland in 1931.]—*Valtion Maatalouskoetoiminnan Tiedonantoja* [Bull. Govt. Agr. Res.], no. 41, 4 pp., 2 figs. Helsingfors, 1932. [Recd. April 1933.]

The chief pests of cruciferous crops were Halticids and *Phaedon cochleariae*, F., which occurred together over large areas and caused severe damage to turnips, swedes and fodder cabbage, *Phorbia* (*Chortophila*) *brassicae*, Bch., and *Pieris brassicae*, L., which were especially injurious in northern Finland, and, in some localities, *Plutella maculipennis*, Curt., *Lygus pratensis*, L., *Ceuthorrhynchus quadridens*, Panz., and *Tipula oleracea*, L. *Meligethes aeneus*, F., was very injurious to crucifers grown for seed. Sugar-beet was infested by *Pegomyia hyoscyami*, Panz., *Blitophaga opaca*, L., and *Gortyna* (*Hydroecia*) *micacea*, Esp. Peas were attacked by *Sitona* spp. and locally by *Kakothrips pisivorus*, Westw. (*robustus*, Uzel). The most important cereal pests were Elaterids, *Euxoa* (*Agrotis*) *segetum*, Schiff., *Frankliniella tenuicornis*, Uzel, and *Oscinella frit*, L., and, in some northern districts, *Macrosiphum granarium*, Kby. *Amaurosoma* sp. caused considerable damage to timothy [*Phleum pratense*], *Oligotrophus alopecuri*, Reut., and *Chirothrips hamatus*, Tryb., to foxtail grass [*Alopecurus*], and *Apion apricans*, Hbst., and *Haplothrips niger*, Osb., to clover. The larvae of *Charaeas graminis*, L., appeared on grass lands in limited areas.

VAPPULA (N. A.). **Puutarhakasvien tuholaiset kesällä 1931.** [Orchard and Vegetable Pests in Finland in the Summer of 1931.]—*Puutarha*, xxxv, no. 3, pp. 69–71. Hämeenlinna, 1932. [Recd. April 1933.]

Pests of fruit trees included *Aphis pomi*, DeG., *Paratetranychus pilosus*, C. & F., *Eriophyes malinus*, Nal., *Tortrix* (*Cacoecia*) *rosana*, L., *Argyroploce variegana*, Hb., *Exapate congelatella*, Cl., and *Argyresthia conjugella*, Zell., the last-named causing severe damage over large areas.

Currants were attacked by *Incurvaria capitella*, Cl., *T. rosana*, *E. congelatella*, *Pteronus* (*Pteronidea*) *ribesii*, Scop., *Pristiphora pallipes*, Lep., *Capitophorus* (*Myzus*) *ribis*, L., *Amphorophora cosmopolitana*, Mason (*Rhopalosiphum lactucae*, Kalt.) and *Lygus* spp. Cruciferous vegetables were infested by the pests mentioned in the preceding paper, red beets by *Blitophaga opaca*, L., and *Pegomyia hyoscyami*, Panz., onions by *Hylemyia antiqua*, Mg., and *Eumerus strigatus*, Fall., and rhubarb by *Gortyna* (*Hydroecia*) *micacea*, Esp.

KANERVO (V.). **Kaalikoi** (*Plutella maculipennis* **Curt.**) **vaarallinen puutarhatuholainen.** [The Diamond-back Moth, a serious Vegetable Pest.]—*Puutarha*, xxxv, no. 3, pp. 71–74, 7 figs. Hämeenlinna, 1932. [Recd. April 1933.]

The last severe outbreak of *Plutella maculipennis*, Curt., in Finland occurred in 1928. It attacks a variety of wild and cultivated crucifers and has two or three generations a year according to the season, the first adults appearing in late May or early June. The egg, larval and pupal stages last 4–12 days, 2–4 weeks and 8–20 days respectively. The larvae live for about a week as leaf-miners or on the lower leaf-surface and later move to the youngest leaves, which they often completely destroy. The use of a trap-crop, preferably white mustard, and dusting with arsenicals are recommended for control.

Suomen Kasvinsuojeluseuran Julkaisu No. 1. [Publication of the Plant Protection Society of Finland, no. 1.]—20 pp., 14 figs. (Reprints from *Puutarha*, xxxv, no. 3.) Hämeenlinna, 1932. [Recd. April 1933.]

This publication consists of a number of short articles on plant protection, including, in addition to the two noticed above : The Plant Protection Society of Finland and its Aims, by E. A. Jamalainen ; Nicotine as a Material for Plant Protection, by J. Listo ; " Cyanogas " Powder [Calcium Cyanide], by Y. Hukkinen ; and the Control of Insecticides and Fungicides, and the Value of Plant Protection, both by T. Kalervo.

VAPPULA (N. A.) & RAINIO (A. J.). **Kasvinsuojelu.** [Plant Protection (*In Finnish and Swedish*).]—*Valtion Maatalouskoetoiminnan Tiedonantoja* [Bull. Govt. Agr. Res.], no. 46, pp. 71–76, 1 fig. Helsingfors, 1932. [Recd. April 1933.]

This paper was prepared for visitors to the Agricultural Exhibition in Finland in 1932 and gives notes on the departments dealing with injurious animals and plant diseases, various pests and diseases occurring in Finland, and material and equipment for control exhibited.

JENSEN (K.). **Wärme als Bekämpfung gegen Hausböcke.** [Heat as a Measure against *Hylotrupes bajulus*.]—*Mitt. Ges. Vorratsschutz*, ix, no. 2, pp. 15–21, 1 fig., 2 graphs. Berlin, March 1933.

An account is given of experiments in Denmark with heat against *Hylotrupes bajulus*, L., attacking timber in attics [*cf. R.A.E.*, A, xix, 379]. Larvae in billets of wood 5¼ ins. by 5¼ ins. in section were killed in 7–8 hours at 55°C. [131°F.]. In a test in the severely infested attic floor of a large building, a drying machine, as used to dry out newly

erected buildings, was set up outside and the hot air pumped into the attic, the roof having been covered with roofing paper. The operation began at 9 a.m.; in a few hours the temperature reached 60°C. [140°F.] and was kept between that and 70°C. [158°F.] until it was raised towards evening to 75–85°C. [167–185°F.]. The fire was drawn at 10 p.m., when the temperature fell quickly. No living larvae were found in blocks of the timber cut out a few days later. In experiments in which the larvae were exposed free, the approximate periods of survival were 10 minutes at 62°C. [143·6°F.], 12 at 60°C., 15 at 58°C. [136·4°F.], 17½ at 56°C. [132·8°F.], 20 at 54°C. [129·2°F.], 35 at 52°C. [125·6°F.], 90 at 50°C. [122°F.], and 150 at 48°C. [118·4°F.]. The larvae become more resistant as they grow older. In another experiment in which they were placed inside small pieces of wood (2 by 2 cm.) all were killed in 45 minutes at 52°C. and in 22 at 60°C.

van den Bruel (W.). **Contribution à l'étude des mouches de la chicorée-witloof** *Napomyza lateralis* **Fall. et** *Ophiomyia pinguis* **Fall. (Agromyzides).**—*Bull. Inst. agron. Sta. Rech. Gembloux*, ii, no. 1, pp. 17–44, 16 figs., 8 refs. Gembloux, February 1933. (With Summaries in Dutch, German and English.)

An account is given of observations carried out near Brussels in 1931 and 1932 on the Agromyzids, *Phytomyza* (*Napomyza*) *lateralis*, Fall., and *Ophiomyia pinguis*, Fall., which infested chicory (*Cichorium intybus*), the former being much the more common. The geographical distribution and food-plants of both species are briefly discussed, and descriptions of the larvae, pupae and adults are given. There are several generations a year, which overlap, all stages being present simultaneously during the summer; hibernation occurs in the pupal stage. The adults of *O. pinguis* emerge later than those of *N. lateralis*, the appearance of the first individuals in breeding experiments being delayed by 7–19 days, and of the last ones by 10–49 days. In the field, oviposition takes place apparently on the inner side of the central leaves of chicory plants, and the larvae mine down to the base of the petioles, where they bore winding galleries and pass from one leaf to another towards the heart of the plant. *N. lateralis* penetrates into the root-collar and then to the bottom of the root by mining just below the epidermis, but *O. pinguis* does not seem to develop on roots. Pupation takes place in the gallery. Laboratory observations indicated that the development of the flies is to a great extent dependent on the temperature; the larval stage of *N. lateralis* lasted about 8 days, the pupal 38–44, and adults kept in glass tubes without food lived 5–10 days. It is probable that in the beds in which chicory plants are forced in winter, development would be completed in about two months, the temperature being about 18–20°C. [64·4–68°F.]. The author considers that the forcing beds are infested owing to the introduction of larvae and pupae of *N. lateralis* in the chicory roots, and those of both species in the stumps of leaves left on them. The adults emerge during the winter and oviposit on the young leaflets. In the field, *N. lateralis* has been observed on a number of wild and cultivated umbelliferous plants, including carrot, which probably serve as sources of infestation.

Parasites reared in the laboratory were the Braconid, *Dacnusa leptogaster*, Hal., the adult of which is described, and one individual of the Pteromalid, *Stenomalus muscarum*, L. It has not been ascertained whether they attack the larvae of both the Agromyzids. Of the

insects reared from whole plants, leaves and waste of chicory taken from various localities in February and March 1931, 76 per cent. were *N. lateralis*, 7·5 per cent. *O. pinguis*, and 16·4 per cent. *D. leptogaster*. In April 1932, *O. pinguis* was not obtained, 31 adults of *N. lateralis* and 45 of *D. leptogaster* emerging.

SMOLÁK (J.). **Bejlomorka borová** (*Thecodiplosis brachyntera* **Schwäg.) na pražských kosodřevinách.** [The Pine Midge (*T. brachyntera*) on Prague Dwarf Pine.]—*Ochr. Rost.*, xii, no. 5–6, pp. 100–103, 9 figs. Prague, 1932. [Recd. March 1933.]

Thecodiplosis brachyntera, Schwäg., is recorded as infesting about 50 per cent. of the needles of dwarf mountain pines in a locality in the south of central Bohemia. This Cecidomyiid was observed for the first time in Czechoslovakia in 1921, when it occurred in numbers on *Pinus sylvestris* over a large area in the province of Slovenia, and again in 1924 in southern Moravia. Brief notes are given on its biology [*R.A.E.*, A, xiii, 317]. The larval feeding causes a reduction in the length of the needles, which often become twisted and wither in the autumn.

Infested needles were shaken from the trees and burnt.

MAGERSTEIN (Č.). **O některých škodlivých činitelích na košikářské vrbě v r. 1931.** [Some Factors injurious to Basket Willow in the Year 1931.]—*Ochr. Rost.*, xii, no. 5–6, pp. 149–151. Prague, 1932. [Recd. March 1933.]

As a result of the mild and dry winter of 1930–31 and an unusually warm and dry spring and summer in 1931, outbreaks of various pests occurred on all varieties of basket willow in Czechoslovakia. *Salix viminalis* was attacked by the sawflies, *Cimbex femorata*, L. (*variabilis*, Klug), which also occurred on *S. rubra*, and *Pteronus* (*Nematus*) *salicis*, L., the Noctuids, *Scoliopteryx libatrix*, L., and *Earias chlorana*, L., the Lymantriid, *Stilpnotia salicis*, L., the Notodontid, *Phalera bucephala*, L., and a mite, *Eriophyes* sp. *E. chlorana* was especially injurious, the summer generation damaging 40–50 per cent. of the shoots, and in one locality 80. The Chrysomelid, *Melasoma* (*Lina*) *tremulae*, F., infested *S. purpurea*, and the weevils, *Cryptorrhynchus lapathi*, L., and *Lepyrus palustris*, Scop., caused serious injury to *S. americana*. All varieties of willows were attacked by *Aphis saliceti*, Kalt., and *Cavariella* (*A.*) *capreae*, F., which were very abundant, the Chrysomelids, *Phyllodecta vulgatissima*, L., and *Plagiodera versicolora*, Laich., the Galerucids, *Galerucella lineola*, F., and *Lochmaea capreae*, L., the Halticid, *Chalcoides aurata*, Marsh., and the Cercopid, *Aphrophora salicis*, DeG.

NEUWIRTH (F.). **Dřepčík** *Psylliodes cupreata* **Duft. novým škůdcem cukrovky.** [The Beetle, *P. cupreata*, a new Pest of Sugar-beet.]—*Ochr. Rost.*, xii, no. 5–6, p. 155. Prague, 1932. [Recd. March 1933.]

During 1931 and 1932, the Halticid, *Psylliodes cupreata*, Duft., caused serious damage to sprouting sugar-beet in northern Czechoslovakia. The beetles were very abundant in May 1932, but their increase was checked by cold, rainy weather in June.

BARIGOZZI (C.). **L'unicità della specie** *Gryllotalpa gryllotalpa* **L. e il suo ciclo biologico.**—*Boll. Lab. Zool. Portici*, xxvii, pp. 145–155, 2 figs., 17 refs. Portici, 28th February 1933.

The author has failed to find racial differences in *Gryllotalpa gryllotalpa*, L. In northern Italy, near Pavia, the first nests with eggs were found at the end of May, about a month later than they were observed by Conte in central Italy [*R.A.E.*, A, xvii, 459]. The habits of the larvae and the construction of the nests agreed with those recorded by Conte. In winter the alimentary canals of all stages contained earth only. Both sexes are produced in equal numbers, but more males than females die soon after reproduction. During development, the sexes tend to keep apart, a fact that masks their relative proportions.

[KOSOBUTZKIĬ (M. I.) **Кособуцкий (М. И.). The Noctuid attacking Winter Crops** (*Euxoa segetum* **Schiff.) in the Votsk Autonomous Region (Biology, Ecology and Measures of Control), 1926–1928. (Attempt at a monographic Investigation.)** [*In Russian.*]—Super Roy. 8vo, x+192 pp., 2 figs., 7 pls., 2 fldg. graphs, 54 refs. Izhevsk, Izd. Votsk. obl. Stantz. Zashch. Rast. [Pub. Votsk Reg. Plant Prot. Sta.], 1928. [Recd. March 1933.]

This monograph is based on three years' study of *Euxoa segetum*, Schiff., in the eastern part of the former Vyatka Government, where it is one of the most important pests of winter rye, supplemented by data from the literature. All its stages are described. Separate chapters deal in great detail with its biology, ecology, natural enemies and diseases, the meteorological factors governing its increase, and methods of control. The measures recommended are: broadcasting baits of potato leaves or weeds poisoned with Paris green in the field prior to or at the time of sowing, followed by the destruction of the strips of grass and weeds between the fields; reploughing before sowing; making trenches round the fields to prevent the larvae from migrating to the crop; and trapping the larvae in ditches containing poison baits. The parasites discussed are: the Ichneumonids, *Banchus falcatorius*, F., which was the most important, *Ophion luteus*, L., *Amblyteles negatorius*, F., and *A. vadatorius*, Ill.; the Tachinids, *Gonia capitata*, DeG., and *Cnephalia bucephala*, Mg. (*bisetosa*, Br. & Berg.); the Bombyliid, *Villa hottentota*, L., which has not previously been recorded from this host; and Nematodes, parasitism of the larvae by which varied from 1 to 5 per cent.

MALENOTTI (E.). **Un nuovo ed efficace mezzo di lotta contro le tipule.** [A new and effective Measure against Tipulids.]—*Il Coltivatore*, 1933, no. 3, reprint 7 pp., 5 figs. Casale Monferrato, 1933.

Serious injury to wheat by the larvae of *Tipula oleracea*, L., occurred in some parts of northern Italy in the autumn of 1932. Experiments have shown that a poison bait of 100 parts wheat bran, 90 parts water, and 5 parts barium fluosilicate is effective against them, even at temperatures as low as 10–12°C. [50–53·6°F.], so that it may be used as late as November. It is scattered at the rate of about 40 lb. per acre and is harmless to poultry or other birds.

Franca (A.). **A proposito di una varietà di melo resistente alla tignola.** [Regarding a Variety of Apple escaping severe Infestation by the Apple Moth.]—*Note Fruttic.*, xi, no. 3, pp. 50–52. Pistoia, March 1933.

Referring to the discovery in Verona of a variety of apple that escapes injury by *Hyponomeuta padellus*, L. [*R.A.E.*, A, xxi, 175], the author states that he has long observed in Venetia that apples with retarded vegetation are not attacked or are only slightly infested by it, or by the apple blossom weevil [*Anthonomus pomorum*, L.] if they blossom late.

Paoli (G.). **Osservazioni sulla biologia del** *Dociostaurus maroccanus*, **Thnb. in Italia nelle fasi gregaria e solitaria e sull'azione di alcuni insetti parassiti.** [Observations on the Biology of *D. maroccanus* in Italy in the gregarious and solitary Phases, and on the Action of some parasitic Insects.]—*Nuovi Ann. Agric.*, xii, pp. 627–639, 2 figs. Rome, 1932. [Recd. April 1933.]

In Italy, *Dociostaurus maroccanus*, Thnb., can swarm in two areas, Latium and Apulia, on the mainland, and in the islands of Sardinia and Sicily. In 1932 the locusts hatched in large masses in the littoral zone of Latium, occupying an area over 60 miles long and 6 miles wide. When the adults made their appearance, it was seen that the individuals from the heavily infested zone differed in the proportions of various parts of the body and in coloration from those living scattered elsewhere, the differences on the whole agreeing with those characterising the solitary and gregarious phases.

The habits of the adults of the two phases differ considerably. Those of the solitary phase may be numerous in a locality, but are uniformly dispersed. Locusts of the gregarious phase tend to keep in groups, particularly when they are ovipositing, and are also less active than the solitary ones. Egg-pods of the gregarious phase contain 20–40 eggs, with an average of 32 ; a single egg-pod of the solitary phase examined contained only 16 eggs, and in the ovaries of a solitary female 15 eggs were found. It would appear, therefore, that the productivity of the solitary phase is only half that of the gregarious one. Probably owing to the small size of the egg-pods of the solitary phase, individuals of *Mylabris variabilis*, Pall., which develops in them, were very small in a locality populated by that phase. The life-history of this beetle is described, mainly from observations recorded elsewhere. The Bombyliids, *Systoechus ctenopterus*, Mik., and *Cytherea* (*Mulio*) *obscura*, F., also parasitised the egg-pods.

The Second Meeting of the Committee for the Study of Locust Biology at Algiers.—*Int. Bull. Plant Prot.*, vii, no. 3, pp. M55–M59. Rome, March 1933.

The French African Committee for the study of locust biology met at Algiers in January 1933 and discussed the programme of field investigations to be carried out by special research expeditions. The aim of these was defined as the delimitation of permanent breeding areas of *Locusta migratoria migratorioides*, Rch. & Frm., and of *Schistocerca gregaria*, Forsk. The programme includes the study of the bionomics of the locusts and of their phase transformation ; bioclimatic

studies of their habitats; and investigations of the plant and animal associations to which they belong.

One of the expeditions had proceeded during the last months of 1932 into the area of the Middle Niger, where *L. m. migratorioides* was observed in various phases. A correlation was found to exist between the maturation of the ovaries of females and the period and area of floods. It is therefore planned to undertake a study of this locust in the zone bordering on the flooded plains of the Niger north of Macina during the next rainy season.

JACK (R. W.). **The Locust Campaign.**—*Rhod. Agric. J.*, xxx, no. 3, pp. 194–206. Salisbury, Rhodesia, March 1933.

The recent invasion of Southern Rhodesia by *Locusta migratoria migratorioides*, Rch. & Frm., only involved the north-eastern districts, the first hatchings of hoppers occurring in the middle of December 1932. The swarms of *Nomadacris septemfasciata*, Serv., were much more widespread and invaded most of the Colony, the first hoppers hatching in the middle of January 1933. The incubation period varied from 30 to 47 days, so that hatchings in an infested area extended over a long period, causing great difficulties in control. The areas infested by hoppers of this locust exceeded expectations based upon the observed egg-laying. The hatching was very heavy, and the continual wet weather during the hopper period seriously handicapped control operations. The obvious impossibility of exterminating all the bands of hoppers led to a decision to concentrate attention on those that were more easily accessible.

The permanent breeding grounds of *Nomadacris* remain unknown, but it appears that the present outbreak developed in the countries north of Southern Rhodesia. The southward trend in the swarm movements presents a definite danger to Mozambique, Natal and the eastern and northern Transvaal, which may be invaded next season.

Among the control measures to be used against this locust, spraying with sodium arsenite solution is particularly recommended. It is used largely as a contact insecticide, and if the grass is sprayed immediately in front of a moving swarm, the hoppers are killed by being wetted in passing through the sprayed strip. Dusting with dry sodium arsenite is often impracticable owing to the weather being too wet, and the grass too long during the hopper season. Poisoned baits have not yet been tested, but under local conditions their value is questionable, since the hoppers occur mainly in long grass.

FRAPPA (C.). **Sur** *Platygenia barbata* **MacLeay, Insecte nuisible au palmier à huile en A.O.F.**—*Agron. colon.*, no. 182, pp. 41–44, 1 map, 1 pl., 3 refs. Paris, February 1933.

Serious damage in plantations of oil palms in Dahomey has recently been caused by the larvae of the Cetoniid, *Platygenia barbata*, Afzel., *Elaeis poissoni* being more frequently attacked than *E. guineënsis*. A brief description of the larva and adult is given. Larvae have been found in February at the end of the dry season, and adults in March. Eggs are deposited along the stalks of the leaves, into which the larvae bore at once upon hatching, gradually making their way to the base of the stalk. Pupation takes place near the heartwood in a cocoon 50–55 mm. long made of fibre that the larva removes from the inside

of the stalk. The infested leaves usually wither and die, and the stalks are easily broken by the wind ; in most cases the presence of the larva in the heartwood of the palm causes the decomposition of the surrounding tissues and the subsequent death of the tree. *P. barbata* is widely distributed in West Africa as far south as the Belgian Congo and is known as a pest of *E. guineënsis* in Kamerun. Since very little is known of its biology, control measures are at present limited to the collection of the larvae, pupae and adults, and the removal and burning of the infested leaves.

DELORD (A.). **Report on the Operations for the Control of** *Phytalus smithi* **(Arrow) during the season 1931–32.**—Fol., 9 pp. Mauritius, 1932. [Recd. March 1933.]

In the campaign against *Lachnosterna* (*Phytalus*) *smithi*, Arrow, on sugar-cane in Mauritius in 1931–32, about 357 million adults were destroyed, as compared with 324 million adults and 64 million larvae in 1930–31 [*R.A.E.*, A, xx, 398]. Statistics are given showing the infestation per acre in various localities, including one new centre. The liberation of *Tiphia parallela*, Smith, has been continued, about 12,000 females and 3,000 males being released in various localities. The percentages of parasitism by this Scoliid and *Campsomeris* (*Elis*) *thoracica*, F., varied in different places from 44 to 0·9 and 11·8 to 0·1 respectively.

BRITON-JONES (H. R.). **Preliminary Trials with a combined Insecticide and Fungicide.**—*Trop. Agriculture*, x, no. 3, pp. 80–84. Trinidad, March 1933.

In an attempt to discover a convenient and effective contact insecticide and fungicide, a cheap by-product was obtained from a Trinidad oil company, that mixes readily with water, has good wetting and insecticidal powers and is a solvent of elemental sulphur. On dilution with water and exposure to the air, the sulphur becomes colloidal and so acts as a fungicide and protection against subsequent fungus infection. The oil-sulphur compound as manufactured is known as "sulphemulsol." Strong evidence of its efficacy on tropical crops in Trinidad has been obtained, and as it does not cause injury to dormant buds of plants grown in the tropical and temperate regions and in addition has bark-cleaning qualities, it may be of value as a winter wash in cold climates, though whether it can be used in dilution on such plants in leaf requires further investigation.

A nursery of limes, oranges and grapefruit worked as scions on sour-orange stock was completely freed from infestation with *Solenopsis geminata*, F., by the thorough application of this compound to the plants and soil at the crowns at 4 per cent. strength. These ants do little damage to *Citrus* when the soil is firm and dry, but the present methods of controlling scab on sour orange by growing under shade will cause an increase in their importance in view of the resulting moist conditions of the soil. *Lepidosaphes beckii*, Newm. (purple scale) and *Chrysomphalus ficus*, Ashm. (*aonidum*, auct.) (Florida red scale) were controlled by a strength of 3 per cent., though in cases of severe infestation, particularly of the former species, a second application within 3–4 weeks is advised. At this strength the spray did not injure the leaves or fruit of several species of *Citrus*, though it damages trees

in blossom. In the subsequent experiments noticed the compound was used at a dilution of 2 per cent. It caused almost instantaneous death of thrips on cacao without injury to the leaves, and of several species of mealybugs with their attendant ants. Immersion of seeds of cereals and pulses for one minute was fatal to *Calandra* spp., and *Bruchus* (*Pachymerus*) *quadrimaculatus*, F., and had no adverse effect on the germination of these and other seeds, a list of which is given. The spray did not control the older larvae of a Geometrid on *Phyllanthus distichus*, but when used on maize, with subsequent spraying with water to eliminate injury, it gave encouraging results against *Laphygma frugiperda*, S. & A. Tests indicating the value of this material as a fungicide are described. It was also found that calcium arsenite could be combined with it at the rate of ½ lb. with 2 lb. lime to 50 gals.

HASEMAN (L.). **The Sorghum Worm in Missouri.**—*Bull. Missouri Agric. Expt. Sta.*, no. 320, 8 pp., 6 figs. Columbia, Mo., January 1933.

Sorghum, which is an important crop in southern Missouri, is not usually much damaged by insect pests, but a serious outbreak of *Celama sorghiella*, Riley, occured on it in 1921. All stages of this Arctiid are described. It is most destructive to the grain sorghums, but broom corn and sweet sorghums are also severely attacked and in 1922 an early summer brood appeared on ripening rye and timothy grass [*Phleum pratense*]. The eggs are attached to the sorghum heads or grains, and the larvae feed on the maturing grains, hollowing them out almost completely. In 1921 a loss of 70–100 per cent. of grain was reported from 11 counties. Records of the seasonal occurrence of the larvae in different years are given, which indicate that there are three generations a year of increasing size. The second, however, was not actually observed, no records being available between 3rd July and mid-August. Late maturing sorghums suffer more severely than the earlier varieties, the severest damage occurring between the middle of August and the middle of October. The winter is passed as a fourth instar larva, and in the laboratory in 1930 the fourth instar lasted until 6th May, the fifth until 13th, and the adults emerged on 21st. Hibernation takes place within the heads, behind the blades in grain sorghums or within the pith of broom corn. No cocoon is formed in winter, and low temperatures did not appear to harm the larvae; in 1929, 70 per cent. survived when the temperature fell as low as 16°F. below zero.

Four parasitic Hymenoptera emerged in the breeding jars, *viz.*, an undescribed species of *Apanteles*, the Pteromalid, *Catolaccus aeneoviridis*, Gir., which was probably a hyperparasite attacking this Braconid, *Trichogramma minutum*, Riley, and *Eupelmus popa*, Gir. The last-named had probably emerged from the sorghum midge [*Contarinia sorghicola*, Coq.], which also appeared in the jars.

The crops should be sown early and ripening hastened by careful soil management and cultivation. Measures should also be taken to eliminate the hibernating larvae, including the removal of all fodder and unthreshed grain heads before spring, pasturing the fields in winter, ploughing after the removal of the crop, and burning hedges and adjoining waste areas.

PARKER (D. L.). **The Interrelations of two Hymenopterous Egg Parasites of the Gipsy Moth, with Notes on the Larval Instars of Each.**—*J. Agric. Res.*, xlvi, no. 1, pp. 23–34, 6 figs., 3 refs. Washington, D.C., 1st January 1933.

The Eupelmid, *Anastatus disparis*, Ruschka, and *Ooencyrtus* (*Schedius*) *kuvanae*, How., imported against *Porthetria dispar*, L., in the forests of the New England States [*R.A.E.*, A, xiii, 433], are now established over a considerable area. Females of *O. kuvanae* come out of hibernation in April and oviposit in overwintering eggs of the host. There are probably four complete generations and a partial fifth in a year. Adults, of the first emerge at the end of May, those of the second early in July and the third (the first that is able to develop entirely in newly-deposited host eggs) early in August. *A. disparis* is normally single-brooded, hibernating as a fully fed larva in the host egg. The adults emerge in June, July or August; their maximum emergence in July coincides with the maximum oviposition of *P. dispar*, to the life-cycle of which this parasite is altogether better adapted than *O. kuvanae*, besides being better able to stand the New England winter. The pupal period of *P. dispar* is recorded, from unpublished data, as lasting about 11 days for the female and 14 for the male.

In two series of experiments to determine the effects of possible competition between the parasites, individual host eggs attacked by *A. disparis* were exposed at various stages to the females of *O. kuvanae*, and eggs attacked by *O. kuvanae* to *A. disparis*. The first series probably represents the order more likely to occur in nature. *Ooencyrtus* was found to be unable to oviposit in eggs containing larvae of *Anastatus* after these had reached the 6th, or sometimes the 8th, day of development, being apparently deterred by the movement of the larva disturbed by the drilling operations. In a few instances *Ooencyrtus* developed from eggs laid earlier than this, but, as *Anastatus* often punctures eggs of *P. dispar* merely to feed on them and this act cannot, within 4 days, be distinguished from oviposition, it is possible that in these instances no larva of *Anastatus* was actually present in the host egg. When larvae of both species were certainly present, those of *Ooencyrtus* never survived beyond the third instar.

The second series of experiments was also confused by the feeding habit of *Anastatus*. In the field the host eggs, being protected by a coating of hairs, would be much less liable to such attack. In several instances, the larva or pupa of *Ooencyrtus* was killed by it, either directly or, in an instance of early attack, through the reduction of the food supply. The few *Anastatus* larvae that reached maturity were derived from eggs that had been laid within a day of those of *Ooencyrtus*. Wherever both species were found together in one host egg, all the *Ooencyrtus* larvae and pupae were dead, and the *Anastatus* larvae (no pupae were found) were dead or barely alive. In no instance did either species complete its development when oviposition by *Anastatus* occurred after the *Ooencyrtus* larva had reached its second instar.

Attempts to reproduce an example previously recorded (1911) of *Ooencyrtus* acting as an internal parasite of hibernating *Anastatus* larvae suggested that such hyperparasitism may sometimes occur, but only in larvae already dead or dying.

The author concludes that there will be no serious competition between the two species except in the unlikely event of combined parasitism approaching the limit of available host eggs; *Anastatus*

does not suffer by attack from *Ooencyrtus*, and *Ooencyrtus* very little from *Anastatus*.

Five larval instars of both *A. disparis* and *O. kuvanae* are distinguished ; previous observers have recorded only three.

Stearns (L. A.), Haden (W. R.) & MacCreary (D.). **Results with some of the Sprays suggested recently for improved Codling Moth Control.**—*Trans. Peninsula Hort. Soc.*, 1932, pp. 78–88. Dover, Delaware. [1933.]

Owing to the abnormal heat and drought in the summers of 1930 and 1931, severe outbreaks of the codling moth [*Cydia pomonella*, L.] occurred throughout all the apple-growing districts of the United States. The situation in Delaware during 1930–32 is reviewed, details being given of the prevailing weather conditions and of the variation in the early seasonal occurrence of the moth. The injury was generally less severe in 1931 than in the preceding year and showed a further decrease in 1932.

The following is taken from the authors' summary of the results of spraying experiments in 1932 : None of the arsenical substitutes suggested recently for improved codling moth control is more effective than lead arsenate. The use of those that proved equally effective would increase production cost, because of the higher price of such materials and the expense involved in the greater number of applications necessary. Certain spreaders and adhesives, such as fish oil, appear to increase the efficiency of the first brood cover sprays of lead arsenate at but slight additional cost and with no appreciable injury to either fruit or foliage.

Headlee (T. J.). **Orchard Conditions which render satisfactory Summer Control of Codling Moth impractical.**—*Trans. Peninsula Hort. Soc.*, 1932, pp. 89–97. Dover, Delaware. [1933.]

The infestation of young orchards by the codling moth [*Cydia pomonella*, L.] apparently spreads from older trees in the same or adjacent plantings, as well as from used fruit packages brought into the orchard and from adjacent packing houses. Since the moths seldom move beyond a distance of 500 feet, the primary population in an orchard is evidently developed on the spot. Under favourable weather conditions, combined with a scarcity of natural enemies and inadequate treatments, infestations are liable to become so heavy that summer sprays may fail to give satisfactory control. This was confirmed by experiments, details of which are given, carried out in New Jersey in two orchards, in one of which the density of the moth population was very high, whereas in the other it was low. It is suggested that control of the overwintering larvae, 75–90 per cent. of which, under the orchard conditions of New Jersey, occur on the trunk and rough bark of the limbs and the rest in pruning scars and cankers, would materially reduce the orchard population and greatly facilitate the prevention of injury to the following crop. As pine oils applied with a brush to the tree have proved very effective against the hibernating larvae, orchard experiments with a proprietary product consisting of steam distilled pine oil fractions were carried out in the dormant season of 1932, about 300 trees being treated. Inspection of a few trees after 10–14 days showed 59 per cent. of the larvae dead,

the mortality being increased to 95·8 per cent. on trees treated with particular care, as compared with 27 per cent. on untreated ones. Injury by first brood larvae showed a reduction of about 50 per cent. where the pine oil had been used ; and after the second brood had developed, the percentage of uninfested fruits from the brushed trees was four times as large as from untreated ones and slightly higher than from those that had been scraped and banded. Scraping is undesirable if pine oil is to be used, since it does away with the rough bark that attracts the hibernating larvae to the trunks and large branches. Care, however, should be exercised in applying pine oil, as it is able to penetrate the buds and kill them, and may also injure the living layers of bark surrounding a new pruning scar.

Cory (E. N.). **Seasonal History of the Codling Moth.**—*Trans. Peninsula Hort. Soc.*, 1932, pp. 98–101. Dover, Delaware. [1933.]

Cage records in 1930–32 show that the peaks of emergence of the overwintered generation of the codling moth [*Cydia pomonella*, L.] at various points in Maryland coincide very closely. A delay was, however, observed in a cage placed in a packing shed where no contact moisture was received, emergence being protracted up to about 1st July. Experience has proved that effective control is obtainable in this State by measures against the overwintering larvae and the first brood, but a complete covering of poison on foliage and fruit has to be maintained throughout the spring till 15th July. Inspection of discarded fruit showed that in certain parts of Maryland apples were more severely infested by the oriental fruit moth [*C. molesta*, Busck] than by *C. pomonella* in 1932.

Worthley (H. N.). **Does San José Scale warrant special Consideration in our Pest Control Program ?**—*Trans. Peninsula Hort. Soc.*, 1932, pp. 102–106. Dover, Delaware. [1933.]

Though the San José scale [*Aspidiotus perniciosus*, Comst.] is not at present abundant enough in Delaware and neighbouring States to have a serious effect on the vitality of apple trees, its numbers are increasing and a larger amount of scale-marked fruit is produced, this being to a great extent due to the lack of adequate spraying. The scale can be controlled by dormant or delayed dormant sprays containing winter strength lime-sulphur or oil, if they are thoroughly applied. Various factors that have tended to prevent the proper use of such sprays are discussed, and reference is made to experiments carried out in Pennsylvania [*R.A.E.*, A, xxi, 128] showing the value of supplementary foliage treatment with lime-sulphur in preventing scale-marking of the fruit.

Stearns (L. A.) & Haden (W. R.). **An effective supplementary Measure for Control of the Plum Curculio on Peach.**—*Trans. Peninsula Hort. Soc.*, 1932, pp. 107–112. Dover, Delaware. [1933.]

The occurrence of a partial second generation of the plum curculio [*Conotrachelus nenuphar*, Hbst.] on peaches in southern Delaware [*R.A.E.*, A, xxi, 48, etc.] is the probable explanation of the fact that in this area spraying alone does not provide adequate control. Special consideration has therefore been given during the last three years to supplementary measures ; and collection and proper disposal of fallen

peaches infested with the first-brood larvae [*cf.* xix, 492 ; xx, 429, 645] has proved an effective means of reducing the population of the weevil. Since hibernation occurs in the adult stage in woodlands and waste fields, as well as in fence rows, pruning piles and rubbish, the weevils concentrate in the spring and summer in the marginal part of an orchard. Experiments in which they were jarred from peach trees growing at varying distances from the edges of the orchard showed maximum infestation in the five marginal rows. It was also found that the heaviest drop of peaches takes place during the last week in May and the first two weeks in June, the peak of infestation being reached about 1st June ; the fallen fruit should therefore be collected at least twice during this period, especially along the edges of the orchard.

HINDS (W. E.), OSTERBERGER (B. A.) & DUGAS (A. L.). **Review of six Seasons' Work in Louisiana in controlling the Sugar Cane Moth Borer by Field Colonisation of its Egg Parasite** *Trichogramma minutum* **Riley.**—*Bull. Louisiana Agric. Expt. Sta.*, no. 235, 36 pp., 2 graphs, 12 refs. Baton Rouge, La., January 1933.

Investigations of the value of *Trichogramma minutum*, Riley, as a parasite of *Diatraea saccharalis*, F., were first undertaken in Louisiana in 1925, and in this paper a review is given of the information obtained since 1927 on the effect of its liberation in reducing the population of the moth borer [*R.A.E.*, A, xx, 289, etc.]. Work done in 1932 is discussed particularly, and reference is made to the position as regards similar investigations in Barbados [xix, 720 ; xx, 98, 402] and Mexico [xviii, 576]. Methods of handling the parasite material for the colonies are recommended.

The following is taken from the authors' summary and general conclusions : Throughout the investigations the work has been generally consistent, economical and dependable. The liberation of colonies will probably be necessary each season as indicated by the situation and will effect a saving of one-third or more of the loss that would have resulted under conditions of natural development of the parasite. Liberations on maize and sugar-cane have shown consistently beneficial results in the rapid increase in the rate and proportion of host eggs destroyed. On maize, in 8 comparable control fields the average natural percentage of parasitism increased between 15th June and 30th July 1932 from 17·4 to 53·5, whereas in 11 colonised areas in which it was originally 16·3, the addition of 6,000 individuals of *T. minutum* per acre resulted in an average parasitism of 82·8 per cent. at the end of July. Among the sugar-cane fields compared, the natural parasitism was 6·9 per cent. in all the control fields, 11·3 per cent. in the colonised areas and 3·3 per cent. in the "adjacent" ones, which received most of their parasites from neighbouring colonised maize fields. Within 3 weeks the percentage was 5 times as great in the colonised and adjacent areas and 3 times in the controls, and parasitism in these two areas exceeded that in the controls by an average of about 28 per cent. throughout the season until 10th September. The liberation of the colonies caused a reduction in the damage by *D. saccharalis*, as estimated by the percentage of joints bored (31·8 in control fields and 13·5 and 12·3 in colonised and adjacent ones), the number of emergence holes found and the moth population produced

per acre, and a considerable increase in the healthy stalks, amounting to about 6,000 per acre or 30 per cent. The corresponding increase in weight of millable cane amounted to more than 3 tons per acre, together with an average rise of over 20 lb. sugar per ton, in colonised and adjacent areas.

The cost of liberation and the gross value of the increased yield of sugar (at about 1½*d.* per lb.) averaged 4*s.* and £5 16*s.* [at par] per acre respectively.

Cushman (R. A.). **Descriptions of new Ichneumon-flies, with taxonomic Notes.**—*Proc. U. S. Nat. Mus.*, lxxxii, art. 14, no. 2955, 16 pp. Washington, D.C., 1933.

Among the new Ichneumonids described are *Ichneumon* (*Amblyteles*) *heterocampae* from *Heterocampa guttivitta*, Wlk., in Massachusetts; *I.* (*A.*) *ctenuchae* from *Ctenucha virginica*, Charp., in Maine ; *Hemiteles pinifoliae* reared in Massachusetts from pine needles infested by *Paralechia pinifoliella*, Chamb., but whether as a primary or secondary parasite is not known; *Alophosternum* (gen. n.) *foliicola* from *Phyllotoma nemorata*, Fall., in Massachusetts, New Hampshire and Maine, and *Paraclemensia acerifoliella*, Fitch, in Maine ; *Mesoleius phyllotomae* reared in Massachusetts from cocoons of *Phyllotoma nemorata* collected in Austria ; and *Lathrolestes metalli* from *Metallus rubi*, Forbes, and *L. rufigaster* from *M. bethunei*, MacGill, both in Ontario. A series of what appeared to be *Tranosema pedellum*, Hlmgr., but differing in certain characters which are described, was reared in Massachusetts from *P. nemorata* from material imported from Austria. *Phaeogenes ineptifrons*, Gah. [*R.A.E.*, A, vii, 321] is a synonym of *Proscus walshiae*, Ashm., which was originally described from *Walshia amorphella*, Clemens, and has become one of the most important parasites of the pupae of *Cydia* (*Grapholitha*) *molesta*, Busck, in the United States. *P. walshiae* var. *australis*, n., was reared in Georgia from pupae of *C.* (*Laspeyresia*) *caryana*, Fitch, that had been isolated as larvae.

Newell (W.). **Report of the Plant Commissioner for Biennium ending June 30, 1932.**—*Rep. St. Plant Bd. Fla. 1930–32*, pp. 9–23. Gainesville, Fla., February 1933.

This report on the work of the State Plant Board of Florida includes information on the finding in November 1930, and again in October 1931, of localised infestations at Key West of hog plums (*Spondias* sp.) by the West Indian fruit-fly, *Anastrepha fraterculus*, Wied. In January 1932, rules were adopted prohibiting the removal of host fruits from the island of Key West and adjacent Keys and providing for spraying and other measures for eradicating the infestation. In November 1932, however, a heavy infestation was discovered at Key West, the larvae being found not only in fruits of *Spondias*, but also in guavas, Surinam cherries [*Eugenia uniflora*], etc.

Reference is made to the discovery of the pink bollworm of cotton [*Platyedra gossypiella*, Saund.] in Dade County and on the Keys [*R.A.E.*, A, xx, 682], and to the experiments carried out in Cuba in the control of the blackfly and green scale [*Aleurocanthus woglumi*, Ashby, and *Coccus viridis*, Green] with hydrocyanic acid gas [xx, 514].

STEARNS (L. A.), WILLIAMS (L. L.) & MCCREARY (D.). **Department of Entomology.** [Annual Report for the Year ending 30th June 1932.]—*Bull. Delaware Agric. Expt. Sta.*, no. 179, pp. 29–37. Newark, Delaware, December 1932. [Recd. March 1933.]

The unusual prevalence of pests of importance in Delaware during 1932 is attributed to the mild conditions during the preceding winter. *Popillia japonica*, Newm. (Japanese beetle) has continued to spread southwards into the State, the infestation in one locality increasing 500 per cent. *Rhagoletis pomonella*, Walsh (apple maggot) was found, for the first time in the State, in maturing apples on unsprayed trees. The Cassidid, *Metriona bivittata*, Say, caused serious damage to sweet potatoes. An extremely severe infestation of *Erythroneura comes*, Say (grape leafhopper) occurred as the result of protracted high temperatures and dry conditions during 1930 and 1931, but was eventually controlled by natural enemies and unfavourable weather conditions in the spring of 1932. A detailed study of the seasonal history on vines in the insectary showed that about a month is required for development of each of the two annual generations, the egg stage averaging 14·3 days. In investigations on *Conotrachelus nenuphar*, Hbst. [*cf. R.A.E.*, A, xxi, 47] it was found that from 1928 to 1932 the emergence of the first individuals from hibernation coincided with the date of application of the petal-fall spray on peaches, and that over-wintered adults were most active during the period in which protection is afforded by the shuck and first cover sprays.

Two oil sprays (Volck and Orthol K) have shown considerable promise in the control of *Cydia* (*Grapholitha*) *molesta*, Busck (oriental fruit moth). They tend to inhibit oviposition on the foliage, and laboratory tests indicate that at concentrations above 0·5 per cent. they possess a high ovicidal value, though they are less efficient as larvicides. In orchards, injury to the twigs of peaches by the first and second broods has been greatly reduced, and injury to the fruit of peaches and apples materially lowered. No foliage injury has occurred from the use of these oils at a concentration of 2 per cent. on peach and 1 per cent. on apple.

BALCH (R. E.). **The Black-headed Budworm.**—*Spec. Circ. Dept. Agric. Canada*, [no. 7] 2 pp., 1 pl. Ottawa, November 1932. [Recd. March 1933.]

This further circular [*cf. R.A.E.*, A, xix, 123, 576] deals with *Peronea variana*, Fern. (black-headed budworm). The eggs, which are laid on the lower surface of the needles of conifers in August and September, hatch about 1st June, and the young larvae construct a web and feed on the new growth of the opening buds, the larger ones migrating to the older needles in cases of severe infestation. Over-topped trees and reproduction may be completely defoliated in one season. West of the Rocky Mountains outbreaks have occurred on hemlock [*Tsuga*], etc. [*cf.* xix, 36], but in eastern Canada serious damage only occurs in stands containing a considerable percentage of more or less mature balsam fir [*Abies balsamea*]. The new growth of white spruce may be destroyed, but the old needles are not attacked and the buds are not killed ; the red and black varieties of spruce are only lightly attacked. Pupation occurs about the latter part of July, by which time the trees appear a reddish brown, and the adults emerge in 10 days and are in flight during late August and the greater part of September.

The danger of outbreaks will be reduced and the possibility of damage minimised by growing in mixtures and on a short rotation. Pure stands of balsam fir should be cut and spruce reproduction should be encouraged where possible. Dusting with calcium arsenate will kill the older larvae, but owing to the protection afforded by the webs, only a heavy application will be effective.

Summary for 1932.—*Insect Pest Surv. Bull.*, xii, no. 10, pp. 415–428, 8 maps, multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Ent. [1933.]

This summary presents notes on the noxious insects recorded throughout the United States during 1932. The distribution of the following is indicated by maps: *Mayetiola* (*Phytophaga*) *destructor*, Say, which was exceptionally injurious throughout the area in which winter wheat is grown; the peach borer [*Aegeria exitiosa*, Say], which is possibly associated with the disease known as phoney peach; *Epilachna corrupta*, Muls. (Mexican bean beetle), which caused considerable damage to beans; *Listroderes obliquus*, Gyll. (vegetable weevil), which has been found in new localities in the north-west and north-east; *Diabrotica balteata*, Lec. (banded cucumber beetle), which damaged maize and a variety of vegetable crops; the sweet potato weevil [*Cylas formicarius*, F.], which has been found in south-eastern Georgia, many miles north of the generally infested area in Florida; *Tibicen* (*Magicicada*) *septemdecim*, L. (periodical cicada), brood VI of which was unimportant and scattered, covering a wider range than any other of the 17-year ones; and the gladiolus thrips [*Taeniothrips gladioli*, Moult. & Stnw.].

Profenusa collaris, MacG. (cherry sawfly leaf-miner), which is present in Massachusetts and has been a minor pest of cherries and ornamental hawthorns in New York since 1914, was discovered for the first time in Michigan on morello cherries. *Dasyneura mali*, Kieff. (leaf-curling apple midge), which has not apparently been recorded previously from the United States, seems to be established in one locality in Massachusetts. *Cnephasia longana*, Haw. [*R.A.E.*, A, xviii, 380] was of fair importance in Washington State, attacking a number of plants in addition to strawberries, particularly the blossoms of bulbous iris. A record of the Tenebrionid, *Crypticus obsoletus*, Say, injuring strawberries in Mississippi appears to constitute the first instance of its attacking crops, although it is indigenous to the south-eastern United States. *Tetranychus pacificus*, McGregor (Pacific red spider), a serious pest of European grapes, has spread to the south of its previous range in California. *Hypera rumicis*, L., is well distributed throughout the United States on rhubarb and several species of dock (*Rumex* spp.), but has not been of economic importance until it was found causing serious damage to the leaves and blossoms of sorrel (*R. acetosella*) grown for seed in Connecticut. *Diprion polytomum*, Htg., which has caused rather severe defoliation of spruce in Quebec [xx, 590], was discovered in Maine.

Swezey (O. H.). **Summary of Insect Conditions in Hawaii for 1932.**—*Insect Pest Surv. Bull.*, xii, no. 10, pp. 429–431, multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Ent. [1933.]

Most of the insects referred to in this summary have been already recorded from Hawaii [*R.A.E.*, A, xx, 225, 721; xxi, 133, etc.]. In addition to *Spodoptera mauritia*, Boisd. [xxi, 15], extensive outbreaks

of *Cirphis unipuncta*, Haw., also occurred on sugar-cane in several localities in the early part of the year. The numbers of *Carpophilus humeralis*, F. (souring beetle) have increased enormously, as a result of the suitable breeding-places provided by pineapples left to rot in the fields, owing to the limited output of the canning factories. In a pineapple field that was ploughed and planted with sugar-cane, the beetles were present in sufficient numbers to cause considerable damage, destroying the " eyes " and boring in the ends of the " seed " cuttings. The Delphacid, *Megamelus proserpina*, Kirk., has apparently been eradicated, as it was not present in a district in which taro [*Colocasia*] had been badly infested in 1931, when it was recorded from Hawaii for the first time. *Adoretus sinicus*, Burm. (rose beetle), a pest in gardens, is attacked in the larval stage by *Scolia*, and considerable numbers of cocoons of *Tiphia lucida*, Ashm., have been received from the Philippines. The adults of this Scoliid have, however, been slow in developing, so that few have been released. *Taeniothrips gladioli*, Moult. & Stnw., was found for the first time in November, causing the loss of the entire crop of gladiolus in several parts of Honolulu. Examination showed it to be widespread and revealed its presence also on Maui and Hawaii.

STRAND (A. L.). **Montana Insect Pests for 1931 and 1932. Twenty-fourth Report of the State Entomologist of Montana.**—*Bull. Montana Agric. Expt. Sta.*, no. 269, 28 pp., 1 fig., 3 maps. Bozeman, Mta., December 1932. [Recd. March 1933.]

Among the pests recorded is *Chorizagrotis auxiliaris*, Grt., which attacked lucerne and other crops, but was partly controlled by poisoned bran baits. Outbreaks of this moth cannot be predicted in the same way as those of *Porosagrotis* (*Agrotis*) *orthogonia*, Morr. [*R.A.E.*, A, xx, 691]. No heavy infestations of grasshoppers occurred in 1932 or are expected in 1933, but some damage was caused by *Camnula pellucida*, Scud., *Melanoplus bivittatus*, Say, *M. mexicanus*, Sauss., and *M. packardi*, Scud. *M. differentialis*, Thomas, appeared for the first time in eastern Montana, but is not expected to become so destructive there as in South Dakota and Nebraska. In May 1931 considerable damage was done to spring and winter wheat by a newly reported pest, the Tenebrionid, *Blapstinus substriatus*, Champ. The larvae are apparently harmless, but the adults also feed freely on potato, lucerne, mustard and numerous weeds. In one instance they caused about 25 per cent. damage to sugar-beet. In 1932, after heavy spring rains, they were not very injurious. The most severe outbreak of *Loxostege sticticalis*, L. (sugar-beet web-worm) yet recorded in the State occurred in 1932, especially on leguminous crops and in gardens. Of 9 acres of onions, 7 were destroyed by it in 2 days, though they had been sprayed with Paris green. Sugar-beet crops suffered less, since the farmers were better supplied with arsenicals and sprayers. Moderate infestations in gardens were successfully checked by heavy applications of Paris green and lead arsenate. The number of the adults emerging in May and June is believed to have diminished the production of honey.

Entomology.—*51st Ann. Rep. Ohio Agric. Expt. Sta. 1931–32* (Bull. 516), pp. 46–54. Wooster, Ohio, January 1933.

Some of the studies recorded are in continuation of previous ones [*R.A.E.*, A, xx, 320]. C. R. Cutright briefly describes experiments in

the control of *Cydia* (*Carpocapsa*) *pomonella*, L., with bands treated with beta-naphthol [*cf.* xxi, 69, etc.], which gave generally favourable results.

H. L. Gui found in experiments in 1930–32 that infestation of potato with wireworms was greater when this crop was preceded by a mixed one of clover and timothy [*Phleum pratense*] than by clover alone, the percentages of damaged tubers in 1932 being 16–34 in the former case and 9 in the latter.

Experiments by J. P. Sleesman on the effect of soil-moisture on the larvae of *Hylemyia antiqua*, Mg. (onion maggot) show that a greater mortality might be expected in dry seasons.

L. L. Huber, J. B. Polivka, E. G. Kelsheimer and J. R. Savage infer from records published in Ontario and Ohio that a rise or fall in maize production is normally accompanied by a corresponding rise or fall in the numbers of *Pyrausta nubilalis*, Hb. (European corn-borer), though under certain conditions the latter may lag a year behind.

For the control of *Taeniothrips gladioli*, Moult. & Stnw., E. A. Herr recommends the autumn fumigation of the gladiolus corms, in which it overwinters, with a mixture of 3 parts ethylene dichloride and 1 part carbon tetrachloride at the rate of 14 lb. to 1,000 cu. ft. of space for 24 hours at a temperature above 70°F. In spring a more effective measure is to immerse the corms in 0·1 per cent. mercury bichloride for 3–4 hours, which also controls gladiolus scab. Blooms from early plantings are less damaged by the thrips than those from late ones. No satisfactory dust or spray was discovered.

C. R. Neiswander and M. A. Vogel record that parasitism of *Cydia* (*Grapholitha*) *molesta*, Busck, in the chief peach-growing counties of Ohio was distinctly higher than in previous years. The most abundant parasites were *Macrocentrus delicatus*, Cress., in the south, *Glypta rufiscutellaris*, Cress., in the centre, and *Pristomerus ocellatus*, Cush., in the north. In the Lake Erie sections, where *Macrocentrus ancylivora*, Rohw., has been extensively colonised, it has become most abundant, the indigenous *Cremastus minor*, Cush., being next in freqency. In some districts *M. ancylivora* has spread 4 miles in 2 years, and in one, where total parasitism of *C. molesta* reached 63 per cent., it parasitised 25·5 per cent. of the larvae in the twigs.

Neiswander reports that attempts to destroy the ant, *Lasius niger neoniger*, Emery, a serious pest on sandy golf greens, by scattering a bait of 1 oz. Paris green and 1 lb. brown sugar gave good temporary results. The addition of 8 oz. flour made the mixture easier to apply.

BODENHEIMER (F. S.). **Observations on Citrus Insects and their Control in many Parts of the World.**—*Hadar*, iv & v, reprint 105 pp., 13 figs., many refs. Jaffa, 1931–32. [Recd. March 1933.]

The author reviews, from personal observation and from the literature, the problems of the insect pests of *Citrus* in California and, more briefly, in Florida, Hawaii, Japan and Ceylon, together with the attempts made to control them by biological and other methods.

FLINT (W. P.). **Balancing the Entomological Program.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 39–45. Geneva, N.Y., February 1933.

The problem of insect control is discussed in relation to the quality and quantity of production. The full importance of economic entomology cannot be brought out unless the work to be undertaken is considered in its relation to the whole farm programme, and only those

measures should be advocated that are calculated to produce increased returns in crops, or money value of crops, without over-emphasis of the control factors. The crops of each area must be considered according to their value, the relative probability of damage by each insect and the sum that can profitably be expended in relation to the return from the crop. Examples are given of the estimation of average insect hazard in relation to various crops. The ability to predict abnormal abundance of any insect will lessen the cost and increase the efficiency of control, and information as to the likelihood of appearance of new insects in an area should be made available. It is also of importance to know the degree of control that may be expected from any particular measure.

In order to afford the greatest possible assistance to the grower, the entomologist, having ascertained the possibilities of each insect and the factors affecting its abundance each year, what effect these factors have had during the past year and what influence they are likely to exert during the coming one, must consult with representatives of other departments of the work and balance his programme accordingly.

FELT (E. P.). **Observations on Shade Tree Insects.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 45–51. Geneva, N.Y., February 1933.

The following is mainly taken from the author's summary of observations in the north-eastern United States: *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.) (elm leaf-beetle), *Popillia japonica*, Newm. (Japanese beetle) and *Coleophora laricella*, Hb. (larch case bearer) were all as abundant and possibly as destructive in 1932 as in the previous year [*R.A.E.*, A, xx, 284]. The occurrence of the Scoliid parasite, *Scolia dubia*, Say, in large numbers on a lawn badly infested by *P. japonica* and *Cotinis* (*Allorhina*) *nitida*, L., is recorded. Notes are given of *Recurvaria apicitripunctella*, Clem., attacking bald cypress [*Taxodium distichum*], *Calligrapha philadelphica*, L., on silky dogwood (*Cornus amomum*), *Dendrothrips ornatus*, Jabl., on privet, and *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., on yew (*Taxus*). *Agrilus bilineatus*, Web., and *A. anxius*, Gory, were recorded as killing birch trees locally, probably favoured by the recent series of droughts. A bad infestation of rhododendron stems by *Corthylus punctatissimus*, Zimm. (pitted ambrosia beetle) was recorded from Long Island, and *Zeuzera pyrina*, L., was locally prevalent on elms on Nantucket Island. *Elaphidion* (*Hypermallus*) *villosum*, F. (oak pruner) was extraordinarily abundant, and *Scolytus rugulosus*, Ratz. (fruit tree bark-beetle) and *S. multistriatus*, Marsh. (European elm bark-beetle) occurred in great numbers on weak trees.

Pests of pines included *Rhyacionia buoliana*, Schiff., *R. frustrana*, Comst., which has been extremely abundant on Nantucket Island, *Eucosma gloriola*, Heinr., and the Aegeriid, *Parharmonia pini*, Kellicott. *Corythuca ulmi*, Osb. & Drake, on elm, and *C. ciliata*, Say, on sycamore [*Platanus occidentalis*] were unusually prevalent, and *Gargaphia tiliae*, Walsh, was locally abundant on lime trees. *Eriophyes* sp. was numerous on elms in two localities in Massachusetts, and *Phyllocoptes quadripedes*, Shim. (maple bladder gall) was extremely abundant on soft maple in New York State. *Toumeyella liriodendri*, Gmel., was quite prevalent on tulip trees [*Liriodendron tulipifera*], though it was preyed upon locally by the larvae of *Laetilia coccidivora*, Comst. *Chionaspis euonymi*, Comst., has been numerous on *Euonymus*. A

leaf scale, *Fiorinia* sp., near *F. fioriniae*, Targ., is becoming established and injurious on hemlock [*Tsuga*] in several localities. The Chinese Mantid, *Paratenodera sinensis*, Sauss., has been abundant in south-western New England and south-eastern New York. Egg-masses had been colonised in one locality in Connecticut in 1930, but it would appear that some other agency must have been responsible for its present widespread occurrence.

Summers (J. N.) & Burgess (A. F.). **A Method for determining Losses to Forests caused by Defoliation.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 51–54, 3 refs. Geneva, N.Y., February 1933.

To facilitate the determination of the extent to which expenditure for the control of insects causing defoliation of forest trees is justifiable, formulae based on data of June and July defoliation in New England are developed, by means of which a definite monetary value can be assigned to the resulting losses. Both the loss due to the death of the tree and that involved in decrease of growth must be taken into consideration. It is possible to place a conservative value, based on cordwood values, on trees killed by defoliation. Methods of estimating the number of trees killed to an acre and their average diameter are indicated. The stumpage value of the cordwood per unit can generally be ascertained from the woodlot owners or dealers in each case, and the total value of all trees killed may be computed from this by means of the formulae given. The loss due to decrease in growth may be estimated from accurate information as to the percentage of foliage eaten and the acreage affected, since it has been shown that any given percentage of defoliation results in about the same percentage of decrease in growth [*R.A.E.*, A, xiii, 337]. By comparing the number of trees that remain alive with the number present originally, a proportion is obtained that will show the correct allowance to be made for killed trees in estimating the possible annual growth.

Collins (C. W.). **The Oriental Moth** (*Cnidocampa flavescens* **Walk.) in Massachusetts and the Work of its newly introduced Parasite.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 54–57. Geneva, N.Y., February 1933.

Cnidocampa flavescens, Wlk., all stages of which are briefly described, has been known as a pest of fruit and shade trees in Massachusetts since 1906, before which date it had been recorded only from eastern Siberia, China, Korea and Japan. The rate of dispersion from the original colony site has been slow, the greatest extent of advance, which is in a north-easterly direction, being only 14 miles in 26 years. Only one generation occurs annually in Massachusetts. The adults appear from the end of June to the end of July. The eggs are laid singly on the lower surface of the leaves and hatch in about a week, and the larvae first eat small patches of green tissue from beneath the leaves and later skeletonise them. They hibernate in cocoons on the tree, pupating in the following spring. A list is given of the numerous trees attacked, of which those commonly and severely injured include cherry, apple, pear and plum.

C. flavescens continued to increase in the central part of its area of occurrence up to 1930, after which there was a tendency for the intensity of infestation to decline. Counts of cocoons in 9 observation points in the spring of 1931 and of the new cocoons in the autumn of 1932 indicate that the infestation of 1933 will be about one-fourth of

that occurring in 1932. This reduction is mainly due to spraying and other methods of control combined with the work of a few native natural enemies and that of the parasite, *Chaetexorista javana*, Br. & Berg., which has recently been introduced and established [*cf. R.A.E.*, A, xx, 218]. The status of this Tachinid is indicated in a table showing the number liberated in 16 localities and the increasing percentage of parasitism from 1930 till 1933, when in one case it amounted to 100 per cent., the degree of parasitism for all pupae collected being 52·43 per cent. Larval collections for 12 different years from 1916 to 1930 yielded only occasional native parasites (*Compsilura concinnata*, Mg., and *Psychophagus omnivorus*, Wlk.) and these in small numbers. Collections in 1932 of eggs from 8 points showed an average parasitism by *Trichogramma minutum*, Riley, of 5 per cent. Spraying with lead arsenate at the rate of 3 lb. to 100 U.S. gals. water, with fish oil or linseed oil as an adhesive at the rate of 4 oz. to each lb. of poison, will kill the larvae in the early instars, or from 1st to 15th August in the neighbourhood of Boston. After this date the quantity of arsenate should be increased to 4 lb. Where the adhesive cannot be used, the amount of lead arsenate should be increased by 1 lb. in each case. The best results are obtained by spraying two weeks before the first larvae are due to spin their cocoons.

FRIEND (R. B.) & HICOCK (H. W.). **The Status of the European Pine Shoot Moth in Connecticut.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 57–62. Geneva, N.Y., February 1933.

During the last six years, *Rhyacionia buoliana*, Schiff. (European pine shoot moth) has become a serious pest of red pine [*Pinus resinosa*] in Connecticut, where it was first discovered in 1914. Recent plantings of red pine amount to over 9,000 acres. Examination of about 3,000 acres during the last two years has shown that about one-fifth of this area is heavily infested and the remainder lightly so. Records of 92 plantations show that 2 were infested in 1927, 5 more became so during each of the years 1927, 1928 and 1929, 10 more in 1930, and 43 more in 1931. In 1932, when the number of plantations examined was much smaller, only 22 fresh infestations were observed, but the dispersion of the moth was probably just as rapid as in the preceding season. The fact that the adult does not fly far and flies at night when the wind velocity is normally low may account for the relatively slow spread throughout the State. Another means of distribution is the transport of larvae in trees for ornamental plantings. During 1932 infestation was found in 77 nurseries as compared with 31 in 1931 and 17 in 1930.

Within a plantation, the insect population tends to build up around the point of original infestation without a correspondingly rapid lateral dispersion. The adults tend to oviposit in the tops of the trees, so that there is a decrease in percentage of injured tips towards the base. Even when interplanted with *P. resinosa*, white pine [*P. strobus*] has not been observed to be injured, and Scots pine [*P. sylvestris*], the European food-plant of the moth, appears to be less severely injured than *P. resinosa*, though it may be seriously damaged. Heavy infestation of *P. resinosa* normally develops after the moth has been present for about 3 years, larval attack causing deformation, stunting and death of both terminal and lateral tips. Mixed planting affords little protection, and a good site does not seem to give the trees an opportunity

to overcome the injury as long as the moth is present. As none of the red pine plantations in Connecticut is more than 33 years old, it is not yet known whether this tree will become relatively free from damage after it has attained a fair height. Parasites reared from *R. buoliana* collected in 1932 included six species known as larval parasites of *R. frustrana*, Comst., one egg parasite (*Trichogramma* sp.) and an undetermined larval parasite. All parasites reared were native, the host being exotic. Parasitism amounted to 50 per cent. of the larvae in May.

In the discussion that followed, the senior author stated that 2 per cent. commercial summer oil with lead arsenate at the rate of 3 lb. to 100 U.S. gals. gave satisfactory control, the oil killing the eggs and the lead arsenate preventing the larvae from entering the twigs. Investigations of feeding habits showed 11 borings from 5 larvae on one shoot. As regards shipment of ornamental plantings, mugho pine [*P. mughus*] is a source of special danger, as infestation upon it may remain unnoticed for a considerable time.

Dr. Felt stated that he had observed a satisfactory degree of control of *R. buoliana* from spraying with light oil, nicotine and lead arsenate at the time the moths are beginning to fly and again about two weeks later in plantations of considerable size under outdoor conditions.

MacLeod (G. F.). **Some Examples of varietal Resistance of Plants to Insect Attacks.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 62–67, 3 figs. Geneva, N.Y., February 1933.

A series of investigations dealing with the control of *Thrips tabaci*, Lind., on onion and *Lygus pratensis*, L., on celery in New York presents some evidence regarding the susceptibility of plant varieties to insect attacks. Plots of all the varieties of onions and celery obtainable were planted side by side with several replications.

Counts of the number of thrips on 20 onion plants in each variety plot were made at intervals of two weeks during the period of infestation, 5 such counts being made during the season. A list is given of all the varieties tested in receding order of resistance, and details of the data obtained are shown in graphs. Variations in resistance become more marked with the seasonal increase in the numbers of thrips. The domestic varieties or those most susceptible to injury are the types commonly grown on a commercial scale in the region where the tests were conducted. The resistant forms are of the sweet Spanish type and average varieties an admixture of the two types.

Injury to the leaves of 14,632 individual celery plants examined was classified. Injury recorded as slight would not affect the plants for immediate consumption, but would probably impair their keeping quality. Plants suffering either moderate or severe leaf injury would be unfit for use. The proportion of injured leaves on all varieties tested is shown in a graph. The experiments show that green or semi-green varieties are extremely resistant to attack by *L. pratensis*.

In the discussion that followed, R. B. Friend stated that about 30 per cent. of the trees in a spruce plantation in Connecticut infested by the spruce gall Aphid [*Chermes abietis*, L.] had remained for 12 years completely immune from attack, even where their branches were close to infested trees, and another 30 per cent. were so slightly affected that the Aphids had no effect on their growth. The reason for this immunity is unknown.

Leonard (M. D.). **Notes on the Giant Toad,** *Bufo marinus* **(L.), in Puerto Rico.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 67–72, 2 refs. Geneva, N.Y., February 1932.

An account is given of the distribution, life-history and habits of the giant toad, *Bufo marinus*, which has been introduced into several islands in the West Indies for the control of certain injurious insects. It is apparently able to adapt itself to considerable extremes of temperature, since it thrives in the warm climate of the West Indies and has been taken in southern Peru from July to December at an altitude of 6,000 ft. In Porto Rico breeding seems to be continuous all the year round, though in other places it is sometimes confined to the rainy season. *B. marinus* was first introduced into Porto Rico from Barbados in 1920, a few additional individuals being imported from Jamaica in 1924, and is now well established all over the Island. It has been stated that in three months one toad will eat nearly 10,000 injurious insects, which constitute 88 per cent. of its food. Quotations from several authors show the varied nature of its diet. During the autumn of 1931, 301 toads were taken from 18 localities throughout the sugar-growing belt in Porto Rico. Analyses of the stomach contents showed that 51 per cent. by bulk consisted of insects injurious to agriculture, 42 per cent. were neutral species and 7 per cent. beneficial. The injurious insects were largely *Diaprepes* and *Lachnosterna* (*Phyllophaga*). The beneficial ones were *Campsomeris dorsata*, F., a known parasite of white grubs, and all were found in 8 toads taken from the same place at the same time, none of which, however, had eaten *Lachnosterna*. Where plants such as bananas, which attract the adult beetles, are grown, the toads are capable of eating 12·5 beetles a night.

Three shipments of *B. marinus* were made at weekly intervals from March to April 1932 from Porto Rico to Hawaii, the time in transit averaging 3 weeks. A fourth consignment was taken by a shorter route and partly by aeroplane in 13 days. All of the 149 toads shipped arrived in good condition and in October 1932 were doing well. After release near reservoirs young of two sizes were found to be present in Honolulu, indicating two separate periods of deposition of eggs that had been fertilised.

Davis (J. J.). **Justifying Expenditures for Entomological Research.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 72–79. Geneva, N.Y., February 1933.

The following is substantially the author's abstract : Facts that justify Federal and State expenditures for entomological research are summarised, with special reference to the many indirect benefits to agriculture, other than the control of insects, that have resulted from studies on insects and their control.

Hallock (H. C.). **Present Status of two Asiatic Beetles** (*Anomala orientalis* **and** *Autoserica castanea*) **in the United States.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 80–85, 3 pls., 2 maps, 2 refs. Geneva, N.Y., February 1933.

Twelve years after their first appearance in the United States [*R.A.E.*, A, xvii, 444], *Anomala orientalis*, Waterh. (oriental beetle) is now generally limited to an area within 90 miles of New York City,

whereas *Aserica* (*Autoserica*) *castanea*, Arrow (Asiatic garden beetle) is found at widely separated localities from Massachusetts to Virginia. The difference in rate of spread may be due in part to the fact that *Anomala* only flies in bright sunlight on very warm days and rarely moves as far as 50 yds. without stopping, whereas *Aserica* flies in large numbers and for great distances at night when the temperature is 70°F. or above. Although there are few nights in the vicinity of New York when this favourable temperature prevails, the natural spread has been several miles a year. The larvae of both species cause destruction to lawns, but in the adult stage only *Aserica* is injurious to plants. Its feeding on ornamental plants often results in complete defoliation. A shortage of soil moisture, especially at the time the eggs are developing, results in high mortality of both species. It is estimated that the dry summers of 1929 and 1930 caused a reduction of at least 60 per cent. of the population of *Aserica*. It therefore appears that these beetles may not thrive in many inland places where the summer rainfall is much below that of New York, although both would increase in parts of the Southern States where the rainfall is adequate.

In districts heavily infested with *Anomala orientalis* 40–60 larvae to the square foot are often uncovered on lawns, such an infestation causing complete destruction of the turf. The most severe injury in other situations has been found in strawberry beds, where in some cases 90 per cent. of the plants have been destroyed. Observations during the past 6 summers have shown that adults of *Aserica castanea* will feed on more than 100 species of plants, although definite preference is shown for only 20 of these, chiefly shrubs and flowering plants. With the exception of peach and cherry, fruit-bearing trees and shrubs are rarely attacked, and injury to vegetable crops appears to be limited to rhubarb and carrot. The larvae cause considerable injury to the roots of certain ornamental plants as well as to lawns. They have also been found feeding on young beets, carrots, onions and maize, and are particularly attracted by strawberry plants, destroying as many as 75 per cent. in some instances in old beds.

The larvae of both species in lawns are controlled by the application of 15 lb. lead arsenate to 1,000 sq. ft. In the case of a new lawn, where the infestation is very heavy, it is advisable to apply lead arsenate at the rate of 35 lb. to 1,000 sq. ft. and mix it in the soil to a depth of 3 inches. Against the adults of *Aserica* a spray of 6 lb. coated lead arsenate, or 3 lb. lead arsenate and 2 lb. flour, to 50 U.S. gals. water is recommended. A light-trap, in which a 500-watt daylight bulb is suspended above a metal funnel, 3 ft. in diameter at the top, fitted over a pail of water with a film of oil into which the beetles fall, has often captured from 1,000 to 10,000 beetles in a single warm night. Laboratory tests have shown that a violet light produced either by a colour screen or a quartz mercury vapour lamp is even more attractive than a daylight bulb, which in its turn is more attractive than a clear one.

CAFFREY (D. J.) & WORTHLEY (L. H.). **The European Corn Borer Situation in the United States at the Close of 1932.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 85–102. Geneva, N.Y., February 1933.

The following is largely taken from the authors' abstract: New infestations of *Pyrausta nubilalis*, Hb., discovered during 1932 were confined to a very few localities, chiefly along the margin of territory formerly known to be infested. The 1932 survey revealed an increase in

borer population amounting approximately to 6 per cent. in the north central States area, compared with 1931. A similar survey of the eastern States area disclosed a decrease of approximately 2 per cent. compared with the last survey, conducted in 1930. Distinct commercial loss occurred in parts of Michigan, Ohio, New York, Massachusetts, Rhode Island, and Long Island.

Experimental results with the more effective insecticides tested have shown the feasibility of their application for protecting maize and dahlias of high market value. In general, liquid insecticides have proved more effective than dusts.

C. H. Batchelder reports that in 1932 in the two-generation area 3–5 applications of either nicotine tannate or lead arsenate in a 1 per cent. oil emulsion resulted in a 65–80 per cent. reduction of the borer population in sweet maize. F. L. Simanton reports that in Ohio, under one-generation conditions, the best results on dent field maize were obtained with 6 lb. calcium fluosilicate compound in 100 U.S. gals. of a 2 per cent. summer oil emulsion, which produced a reduction of 85 per cent. of the larval population with a single application and 83 per cent. with two applications.

Approximately 5,200,000 imported parasites have been liberated during the last 13 years, and several species are known to have become permanently established. The observations of 1931 revealed continued field maintenance without support of additional field liberations of *Chelonus annulipes*, Wesm., *Angitia* (*Inareolata*) *punctoria*, Roman, and *Ceromasia* (*Masicera*) *senilis*, Mg. (Rond.), three species imported from Europe that represent an excellent parasite sequence in attacking the egg, the young larva, and the more mature larva respectively. Excellent initial establishment is indicated for *Macrocentrus gifuensis*, Ashm., and *Cremastus flavoorbitalis*, Cam., two parasites imported from the Orient and released in the one-generation area for the first time in 1932. Field recovery records during 1932 indicate that the total parasitism by all species ranges from 1 to 50 per cent. in different localities.

Preliminary experiments indicate that the commercial application of new facilities for refrigeration may be employed in the sterilisation of ear maize infested by *P. nubilalis*. Employing a two-station, cold-plate freezer, the thermal decline of the central portion of the cob pith of dry seed ears of field maize and green ears of sweet maize was measured when the ears were subjected to —20°F. For the green ears 4 hours was required to reach 0°F., and for the dry seed maize 70 minutes, the difference being largely explained by the low moisture content of the drier ears, and consequently the very small amount of latent heat to be overcome in bringing the pith to sub-freezing temperature levels. During a 3-hour exposure of dry maize to —20°F., the temperature at the centre of the cob pith dropped to —18°F. Quick freezing at —20°F. by means of a plate freezer was fatal to retarded fifth instar hibernating larvae of *P. nubilalis* in dry ear maize during a 3-hour exposure, and a 48-hour exposure of ear maize to —20°F. in a cold room also killed the infesting larvae. The temperatures employed had no apparent effect upon the germinating capacity of the seed.

Field tests indicate that certain varieties and strains of maize are more resistant or tolerant to attack by *P. nubilalis* than others. The plant characteristics associated with tolerance and resistance are being sought. Plot experiments have shown that for each additional borer in an infested plant there occurs, on an average, a corresponding correlated reduction in yield.

Parker (J. R.). **The 1932 Grasshopper Outbreak.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 102–108. Geneva, N.Y., February 1933.

The following is the author's summary: Unfavourable weather conditions, disease and parasites during 1932 reduced grasshoppers in Iowa, Nebraska and South Dakota to such an extent that crop damage was far below that of 1931 [*R.A.E.*, A, xx, 410–412, etc.]. In Minnesota, infestations were greatly increased over the previous year, but a well-organised control campaign prevented extensive crop losses. North Dakota suffered heavier crop losses from grasshoppers than any other State. Precipitation records in areas having heavy egg infestations in the spring of 1932 showed less than the normal amount of rainfall at stations where outbreaks were as serious as predicted, and more than the normal rainfall where damage was less than that expected.

Ditman (L. P.) & Cory (E. N.). **The Response of Corn Earworm Moths to various Sugar Solutions.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 109–115, 1 graph, 10 refs. Geneva, N.Y., February 1933.

The following is the authors' abstract: *Heliothis obsoleta*, F. (corn earworm moth) responded in varying degrees to ten sugars in solutions. On the basis of molar concentrations, sucrose, invert sugar and fructose proved most attractive in the order named.

Turner (N.) & Friend (R. B.). **Cultural Practices in Relation to Mexican Bean Beetle Control.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 115–123, 4 figs., 6 refs. Geneva, N.Y., February 1933.

For an experiment in 1932 in Connecticut on the effect of rate of planting of string beans in relation to control of *Epilachna corrupta*, Muls., two varieties, one having large leaves and the other small ones, were planted in 6-row plots, the rows being 10 ft. long and 30 inches apart. The spacings were 2, 4, 6 and 8 inches apart in the row. All plots were planted on 23rd May, sprouted on 2nd June and blossomed early in July. Three rows of each plot were left unsprayed and three sprayed with 3 lb. magnesium arsenate and 2 lb. calcium caseinate to 100 U.S. gals. water. The spray was applied to the lower surface of the leaves on 25th June and 11th July for the control of the larvae. The smaller-leaved variety required much less spray material and the 2-inch spacing with each variety required a much larger amount than the other spacings for the same length of row.

Overwintered adults of *E. corrupta* appeared on 6th June, and some foliage injury was noted on 15th June. Counts of egg masses on 16th June showed that in the case of the large-leaved variety the number on the 2-inch plots was much greater in proportion to the number of plants than on the 4-inch plots, and in the case of the small-leaved variety slightly greater. Considerable larval injury appeared on the unsprayed plots, the 2- and 4-inch plots being more severely damaged than the others. On 29th July they were defoliated, whereas the 6- and 8-inch plots were much less seriously damaged. The variations in yield obtained from the different plots are discussed. It was evident that *E. corrupta* preferred closely planted beans for oviposition, and the fact that careful hand spraying did not adequately protect beans planted 2 inches apart justifies a recommendation to plant them at least 4 inches apart in areas where this beetle is a serious pest.

Howard (N. F.), Brannon (L. W.) & Mason (H. C.). **Insecticides for the Control of the Mexican Bean Beetle.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 123–129, 3 refs. Geneva, N.Y., February 1933.

The following is taken from the authors' abstract: Field tests carried out in Virginia over a period of three years indicate that potassium hexafluoaluminate and synthetic cryolite are satisfactory for the control of *Epilachna corrupta*, Muls. (Mexican bean beetle) when used as sprays at the rate of 3 lb. to 50 U.S. gals. water. Barium fluosilicate (80 per cent.) must be used at the rate of 5 lb. to 50 U.S. gals. water to give satisfactory control, and is considered too expensive to be recommended. These compounds have not given satisfactory control when used as dusts. There appears to be no advantage in changing current recommendations for the use of magnesium arsenate, except that the dosage should be increased from 1 lb. to 2 lb. in 50 U.S. gals. water where the infestation is heavy. Even if fluorine compounds are used green beans should not be sprayed after the pods have set.

Calcium arsenate was effective against *E. corrupta* both as spray and dust, but was liable to cause injury to the plants. Bordeaux mixture as a rule caused reduction in yields when used alone or in combination with arsenicals or fluorine compounds in the absence of insect pests, but reduced injury from calcium arsenate. A commercial extract of derris root containing 5 gm. rotenone per 100 cc. gave satisfactory control of *E. corrupta* in Virginia under conditions of light or medium infestation at dilutions varying from 1 : 250 to 1 : 1,000. Under conditions of medium to heavy infestation in Ohio during 1932, at 1 : 250 and 1 : 400 it gave results equal to or better than 2 lb. magnesium arsenate or cryolite to 50 U.S. gals. It seems to be superior to pyrethrum extract and far superior to pure rotenone. Although the cost is high, this extract might be of use on valuable crops after the pods have set. In 1932 a commercial dust containing 0·275 per cent. rotenone gave fair results, whereas one containing 0·15 per cent. rotenone was ineffective in 1931; the present price of this mixture makes it too expensive for general use.

Walker (H. G.) & Anderson (L. D.). **Report on the Control of the Harlequin Bug, *Murgantia histrionica* Hahn, with Notes on the Severity of an Outbreak of this Insect in 1932.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 129–135, 2 refs. Geneva, N.Y., February 1933.

A severe outbreak of *Murgantia histrionica*, Hahn, on vegetable crops in Virginia during the summer of 1932 was due in part to the mild winter of 1931–32 and also to the abundance of preferred food-plants in abandoned fields and in seed kale fields. About the middle of August, when these food-plants dried up, the nymphs migrated elsewhere, seriously damaging early autumn cabbage and killing young kale. They also fed on a number of non-cruciferous plants and weeds. Successful control of the migrating nymphs was obtained by ploughing their breeding grounds and all seriously injured fields. The remaining nymphs were then either hand-picked or sprayed with a 2 per cent. soap solution [*R.A.E.*, A, xviii, 578]. A severe outbreak of the adults that occurred later was more difficult to control. Of a large number of insecticides tested against them in the insectary and in the field, the best results were secured with sprays in which rotenone was the active ingredient in combination with a 1 per cent. soap solution. In general nicotine, pyrethrum and oil emulsion sprays were not effective against

the adults except at very strong concentrations. Preliminary tests with various rotenone dusts gave satisfactory results, but further experiments are required before they can be recommended.

Less than 40 per cent. of the nymphs or adults were able to crawl out when covered with ½ inch loose soil, less than 10 per cent. when covered with 1 inch, and less than 5 per cent. when covered with 2 or more inches. Some of the adults, however, remained alive when buried with young kale plants for a period of at least 17 days. Swallows were observed feeding on the adults. *Ooencyrtus johnsoni*, How., was found to parasitise from 35 to 55 per cent. of all the eggs collected during August and September, 35 parasites being reared from 12 eggs. This Encyrtid, which completes its life-cycle in 16–17 days, was also reared from the eggs of a Coccinellid.

LANGFORD (G. S.). **Observations on cultural Practices for the Control of the Potato Tuber Worm,** *Phthorimaea operculella* **Zell.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 135–137, 2 refs. Geneva, N.Y., February 1933.

Phthorimaea operculella, Zell., sometimes occurs in eastern Maryland on the second crop of potatoes in sufficient numbers to require control. A comparative study of cultural measures in 1930 showed an average of 18·27 per cent. infested tubers in unridged and 5·5 per cent. in ridged fields. The infestation in ridged fields varied from 0·3 to 16·6 per cent. depending on the thoroughness of the operation, height of the ridge, time elapsing between planting and ridging, soil type and the amount of rain falling after ridging. Soils that crack are more heavily infested, and heavy rain washes the ridge down in light soil. Infestation in unridged fields varied from 10·1 to 34·4 per cent. Tests in greenhouses showed 46·2, 4·8, 5·1 and 8·1 per cent. infested tubers among potatoes planted 2, 4, 6 and 8 inches deep respectively and not ridged. The ridged plots at all the depths were free from infestation.

Maintenance of moisture in the soil tends to reduce the number of tubers infested. Potatoes planted 2 inches deep and grown in soil kept wet averaged 5 per cent. infested tubers at harvest as compared with 60 per cent. among those grown in comparatively dry soil.

THOMAS (C. A.). **Observations on the Tomato Pin Worm** (*Gnorimoschema lycopersicella* **Busck**) **and the Egg Plant Leaf Miner** (*G. glochinella* **Zeller**) **in Pennsylvania.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 137–143, 1 fig., 13 refs. Geneva, N.Y., February 1933.

This is a more detailed account of the infestation of tomatos by *Phthorimaea* (*Gnorimoschema*) *lycopersicella*, Busck, in Pennsylvania already noticed [*R.A.E.*, A, xx, 298], which has apparently been eradicated by certain greenhouse practices. A description is given of the various stages of this moth and of the injury caused by it [xix, 654]. *P.* (*G.*) *glochinella*, Zell. (egg-plant leaf miner) is recorded, apparently for the first time, in Pennsylvania, where it was found feeding on horse nettles (*Solanum carolinense*) during the summer of 1932. The distribution of *P. glochinella* is discussed, and certain parasites recorded from it are enumerated [xii, 217]. Its parasites in Pennsylvania in 1932 were *Microdus* (*Bassus*) *gibbosus*, Say, *Microbracon gelechiae*, Ashm., and *M. melanaspis*, Ashm., the last-named being the most common.

Maughan (F. B.). **Naphthalene for the Control of the Onion Thrips.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 143–147, 1 fig. Geneva, N.Y., February 1933.

Excellent control of *Thrips tabaci*, Lind., on onions in New York State was obtained by the use of crude naphthalene. Significant reductions in infestation and increases in yield of the treated plots over the untreated ones were obtained. At each application the naphthalene was used at the rate of 300 lb. to the acre. The most effective control was secured by applying it directly on the row, as this resulted in small particles being deposited in the crevices of the younger leaves and reaching the immature thrips. Two years' observations have shown naphthalene to be more toxic and repellent to the immature stages than to the adults.

Three applications were made at approximately eight-day intervals to seed onions during the season, the period of infestation lasting from about 10th July to 5th August. Although the field under treatment was surrounded on all sides by onion fields, the young thrips did not appear to migrate from them to the treated field.

Hill (L. L.). **Further Studies of Tarnished Plant Bug Injury to Celery.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 148–150. Geneva, N.Y., February 1933.

Studies for the control of *Lygus pratensis*, L. (tarnished plant bug) were continued in New York in 1932 [*cf. R.A.E.*, A, xx, 524].

The following is substantially the author's summary of the results obtained in the two season's work, involving a total of 11 experiments : *L. pratensis* was present in large numbers throughout the season of 1931 and caused severe damage to both early and late celery. The infestation was equally heavy for the first half of the season of 1932, but much lighter during late summer and early autumn, owing to the fact that the second brood was heavily parasitised. Sulphur (300 mesh or finer), when used as a dust and when combined with hydrated lime as a dust or spray (12 lb. of each material to 50 U.S. gals.) gave excellent control in both early and late celery. All dusts were applied at the rate of 75–100 lb. and sprays at the rate of 100 U.S. gals. per acre. An average number of 5 applications was found necessary for control.

Stearns (L. A.). **Observations on the Biology and Control of *Metriona bivittata* Say.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 151–154, 2 pls., 21 refs. Geneva, N.Y., February 1933.

A localised but destructive outbreak of the Cassidid, *Metriona bivittata*, Say (two-striped sweet potato beetle), occurred in 1932 in Delaware, where sweet potato is the chief vegetable crop. Investigation of a severe infestation in July showed that it was largely confined to a single field of about 48 acres and that the degree of injury was definitely associated with the proximity of affected areas to adjoining wooded and waste land. The plant centres had in many cases been completely demolished, with leaves showing varying degrees of injury, and in certain areas no vestige of the plants remained. The history and distribution of *M. bivittata* are briefly discussed. Hibernation occurs in the adult stage in sheltered situations, such as are afforded by the wood and waste lands of the sweet potato growing area of southern Delaware. Overwintered adults were observed in abundance during late May and early June 1932, and all stages of the beetle, which are

briefly described, were present from the end of the second week in June to the close of the corresponding week in July. The eggs are deposited singly on the leaf stems or on the lower surface of the leaves along the larger veins and covered with a small protective mass of black excrement. About 90 per cent. of the larvae had pupated on 15th July and a few recently emerged adults were in evidence. Subsequent observations on 19th and 28th July showed few larvae, many pupae and a preponderance of wintering adults, all of which had left the field by 15th August, a careful search on 12th September failing to locate any of them in the adjoining woods. A few specimens of a closely allied species were, however, collected feeding on wild grape, wild cherry and sassafras. At the height of the infestation, during the first week in July, a Tachinid, *Lydella* (*Anetia*) *dimmocki*, Aldr., was responsible for a 12 per cent. larval parasitism. Dusts of lead and calcium arsenate applied on 6th July to severely affected areas both gave practically complete control and caused only slight injury to the plants, which made an almost complete recovery and produced a satisfactory crop.

Bissell (T. L.). **A Cage for confining Weevils on the Fruit and Foliage of Trees.**—*J. Econ. Ent.*, xxvi, no. 1, p. 176. Geneva, N.Y., February 1933.

The cage described has proved satisfactory in Georgia for confining the adults of the pecan weevil [*Curculio caryae*, Horn] on growing nuts and foliage for insecticide tests. It was made by cutting two openings, $5\frac{1}{2}$ by $3\frac{1}{2}$ inches, in the lower end of each narrow side of a 25 lb. paper grocery bag and covering each with wire screening, 12 meshes to the inch, applied to the margins with shellac. A strip of paper sealing tape was fixed over the four edges of the screen. The cage with insects was placed over the tree branch and tied on with string. Cages used for 12 days were exposed to 0·96 inch of rain during the first 3 days without the paper being torn or the glue dissolved. The cage allows for ventilation and observation and furnishes space for making notes on the outside of the bag, thus obviating the use of an identification tag.

Section of Apiculture.—*J. Econ. Ent.*, xxvi, no. 1, pp. 155–196. Geneva, N.Y., February 1933.

This series of papers includes the following: The new Beekeeping, by E. F. Phillips; Preliminary Observations on "Paralysis" of Honey Bees, by C. E. Burnside; A Plant (*Veratrum californicum*), poisonous to Adult Bees, by G. H. Vansell and W. G. Watkins; Nectar Secretion of the Tulip Tree or Yellow Poplar [*Liriodendron tulipifera*], by G. E. Marvin; Further Notes on the Bee Moth [a review from the literature on *Galleria mellonella*, L.], by F. B. Paddock; Buckeye [*Aesculus californica*] Poisoning of the Honeybee—a Progress Report, by J. E. Eckert; and Efficiency and Economy in Apiary Inspection, by R. G. Richmond.

Patch (L. H.) & Peirce (L. L.). **Laboratory Production of Clusters of European Corn Borer Eggs for Use in Hand Infestation of Corn.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 196–204, 2 pls., 1 ref. Geneva, N.Y., February 1933.

The following is taken from the authors' summary: To study the comparative effect of *Pyrausta nubilalis*, Hb., in reducing the yield

and quality of various strains of maize, it was found necessary to produce, in the laboratory, clusters of eggs with which to hand-infest the maize plants in order to obtain the levels of infestation desired. The most practical method developed was to place infested maize stalks in an emergence cage as a source of moths, to force the moths to oviposit on waxed paper suspended in specially designed cages, to cut from the waxed paper small disks, each bearing an egg-cluster, and to fix these disks on pins, so that they can later be pinned on the maize leaves. A formula is presented for use in estimating the number of eggs that should be placed on each plant to obtain a definite number of mature borers

Metzger (F. W.). **Preliminary Report on Controlling the Winter Emergence of the Japanese Beetle in Rose Greenhouses by Application of Chemicals to the Soil.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 205–210, 2 refs. Geneva, N.Y., February 1933.

Considerable injury to roses in greenhouses was caused during the winter of 1930–31, particularly in February and March, by adults of *Popillia japonica*, Newm., that had emerged from the beds. A number of infested greenhouses, most of which were in Pennsylvania, were inspected, and tests were begun in 1931 with a view to developing a uniform method of control. The experience of other workers had suggested that the introduction of larvicides into the beds at intervals of 3–4 years when the soil was renewed would kill the larvae present and prevent the development of any fresh ones. Preliminary data are given from the results obtained after one year's treatment of experimental beds containing 5 different varieties of roses, which received applications of lead arsenate, barium fluosilicate or hydrated lime after the artificial introduction of larvae of *P. japonica*. The final results, however, will not be available until after the 3-year period has elapsed. Emergence after one year in the untreated bed was 42·8 per cent. of the total number of larvae originally placed in it. Only a negligible number of beetles emerged from plots where lead arsenate had been mixed with the soil at rates varying from 1,000 to 3,000 lb. to the acre to a depth of 6 inches, the greatest number representing 3·3 per cent. of those found emerging from the untreated plot. Lead arsenate or barium fluosilicate used at the rate of 3,000 lb. to the acre gave practically 100 per cent. control. Hydrated lime reduced beetle emergence to 22·9 per cent. of that of the untreated plot, but the number surviving would be sufficient to cause considerable damage. Lead arsenate used as a top dressing reduced emergence appreciably both at the 2,000 and 3,000 lb. rates, but was apparently much less effective than 1,000 lb. to the acre mixed in to a depth of 6 inches.

Satterthwait (A. F.). **Life History and Distribution of the Low-tide Billbug,** *Calendra setiger* **(Chittenden).**—*J. Econ. Ent.*, xxvi, no. 1, pp. 210–217, 12 refs. Geneva, N.Y., February 1933.

An account is given of observations on *Sphenophorus* (*Calendra*) *setiger*, Chitt., in New Jersey. This weevil breeds, so far as is known, chiefly below high tide mark in maritime marshes along the Atlantic coast, in salt reed grass (*Spartina cynosuroides*), which appears to be its only food-plant. Its distribution is discussed and measurements

of the eggs, head-widths of larvae, and pronotal widths and total lengths of pupae are recorded, as well as the characters distinguishing the adults of *S. setiger* var. *intervallus*, Chitt., from those of *S. ludovicianus*, Chitt., which they closely resemble. Reared indoors on maize pith, larvae of *S. setiger* developed in the same period as do species of the genus commonly attacking maize, the egg, larval and pupal stages lasting about 5, 45–51 and 10 days. Weevils reared from eggs laid in captivity wintered successfully, matured, and laid eggs from which a second generation of adults was reared.

The ability of *S. setiger* to adapt itself to maize tissue and to complete absence of sea-water indicates that, like other members of the genus [*cf. R.A.E.*, A, xxi, 189, etc.], it is a potential pest of maize. *Spartina cynosuroides* is used to some extent as wild hay and has been employed in the manufacture of twine and paper. The strong creeping root-stocks adapt it for binding loose sands and river banks, and it is also used in some cases for thatch.

YORK (H. H.). **Some Observations on *Hylobius pales* Herbst.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 218–221, 1 pl., 1 ref. Geneva, N.Y., February 1933.

Records and descriptions of injury caused in 1931 by *Hylobius pales*, Boh., in several localities in New York on stumps and root crowns of *Pinus rigida* and *P. strobus* and root crowns of *P. resinosa* indicate that this weevil possesses a wider range of feeding habits than has been previously recorded. In June 1927 in the course of an investigation of a severe weevil infestation in New York, *H. pales* was secured from infested stumps of *P. sylvestris* together with *Pissodes approximatus*, Hopkins.

MCALISTER (L. C.). **Results of Dusting Experiments to control the Blueberry Maggot.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 221–227, 5 refs. Geneva, N.Y., February 1933.

The reduction of infestation of blueberries by *Rhagoletis mendax*, Curran (*pomonella*, auct.) obtained in experiments with calcium arsenate dust in eastern Maine [*R.A.E.*, A, xviii, 645] was not found adequate to meet the required standards for maggot-free fruit. Experiments in 1931 demonstrated that two applications of calcium arsenate will meet the requirements under conditions of moderate infestation, although complete eradication may not be secured. A further reduction may be obtained by three applications in cases of severe infestation, but there is increased danger of excessive arsenical residues. A period of at least two weeks must intervene between the last application of dust and the harvest of the fruit. One application was found to be inadequate under ordinary circumstances. Two applications of a mixture of equal parts of calcium arsenate and hydrated lime made on 15th and 22nd July gave 91·12 per cent. reduction in the number of maggots, whereas two applications of undiluted calcium arsenate gave a reduction of 92 per cent. in one experiment and 97·47 per cent. in another. Two applications of copper carbonate used as a dust, made on 14th and 22nd July, at the rate of 6·8 lb. to the acre for the first application and 7·6 lb. to the acre for the second in one field test reduced the number of maggots by 97·11 per cent.

Gilmore (J. U.) & Milam (J.). **Tartar Emetic as a Poison for the Tobacco Hornworm Moths, a preliminary Report.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 227–233, 1 fig., 2 refs. Geneva, N.Y., February 1933.

Tests of forty materials, carried out during several seasons in Tennessee in an effort to discover an efficient stomach poison for the tobacco hornworm moths, *Protoparce* (*Phlegethontius*) *sexta*, Joh., and *P.* (*P.*) *quinquemaculata*, Haw. [*R.A.E.*, A, xvi, 400 ; xvii, 181], have shown that a 5 per cent. solution of tartar emetic in water sweetened with white sugar is an effective and satisfactory poison when used in conjunction with isoamyl salicylate as an attractant. Large scale field experiments were conducted in 1929, 1930 and 1931 with promising results. The moth feeder used in 1930 and 1931 consisted of a cylindrical container in the top of which were inserted three funnels, which provided access to the poisoned sugar solution, and a vial to contain the attractant with a wick protruding from it. The container was 6 inches in diameter, 2½ inches deep, and constructed of 26-gauge galvanised iron. The funnels were of 30-gauge galvanised iron, 3 inches long and 1½ inches in diameter at the top, and the small ends reached within ½ inch of the bottom of the container. When exposed in the field the feeder was mounted on a stake 4 ft. high. Practically all the Jimson weed (*Datura stramonium*), to the blossom of which the moths are strongly attracted, was destroyed in the area each year, so that the moths were forced to the feeders. The experiments were begun about 1st July and continued until the tobacco harvest, usually in September. In 1929 the feeders were placed ½ mile apart over the entire area of 9 sq. miles. In the next two years they were placed on elevations of 5–50 ft. near tobacco fields in groups of three and four. Visits were made about every two weeks to add water or refill the vials containing isoamyl salicylate, which was entirely renewed once during each season.

Chamberlin (F. S.). **Barium Fluosilicate as a Control for the Tobacco Flea Beetle.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 233–236. Geneva, N.Y., February 1933.

Epitrix parvula, F., is a major pest of cigar-wrapper tobacco in Georgia and Florida, where it frequently causes severe losses. As the method hitherto employed of controlling this beetle by means of light applications of Paris green has proved unsatisfactory, experiments were begun in 1930 with fluorine compounds, which gave very promising kills under laboratory conditions. Field experiments were carried out in 1931 with a mixture of 80 per cent. barium fluosilicate and 20 per cent. finely divided infusorial earth, applied with a hand duster in which the material passed through a high speed fan. Excellent control of overwintered beetles was obtained, and no apparent scorching resulted. From 80 to 95 per cent. control of the second brood of beetles was obtained by applications of the same dust at the rate of 4–6 lb. to the acre, with only slight traces of scorching. Even when the dust was applied only a few days prior to harvest, the objectionable white residue was removed by light showers. A similar control effected with Paris green showed a loss of 30–40 per cent. scorched foliage. Small-scale field experiments with undiluted barium fluosilicate indicated that even distribution could not be obtained and the residue was only partly removed by light showers. Sodium fluosilicate, even in a dilute form,

caused such severe foliage injury as to make its use upon tobacco entirely impracticable.

More extensive experiments in 1932 indicated that a few thorough applications of the diluted barium fluosilicate to newly set tobacco would eliminate most of the damage caused by the later broods. As considerable scorching resulted from applications made at the emergence period of the second brood of beetles during the latter part of May, following a week's interval of very wet, cloudy weather, this procedure was discontinued. It was found, however, that scorching could be largely eliminated by holding the nozzle of the dust gun in the centre of the tobacco row and allowing the poison to drift on to the foliage. The safety of this method was increased by adding 15–20 per cent. by weight of finely-ground tobacco dust, which improved the feed action of the dusters and greatly increased the distribution of the poison. Excellent control was obtained with dosages ranging from 4–8 lb. to the acre of a mixture consisting of barium fluosilicate, infusorial earth and tobacco dust in the proportions of 8–2–2, with, in most instances, two to three applications. Other experiments indicated that an 8–2 mixture of barium fluosilicate and tobacco dust was somewhat preferable. Neither of these mixtures caused commercial scorching or residue trouble when properly applied.

Stone (M. W.) & Campbell (R. E.). **Chloropicrin as a Soil Insecticide for Wireworms.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 237–243, 4 refs. Geneva, N.Y., February 1933.

A series of experiments have been carried out in California with chloropicrin as a soil fumigant against wireworms. After preliminary experiments which indicated that dilute solutions were definitely toxic to *Pheletes* (*Limonius*) *californicus*, Mann., a vat, 3 ft. square and 1½ ft. deep, containing soil from a typical wireworm infested field was used. This soil was a sandy loam and contained 10–15 per cent. moisture. Small wire screen cages containing soil and wireworms were placed at various depths in the vat, and the soil was firmly packed. An emulsion was made of 20 c.c. chloropicrin, 20 c.c. soap and 140 c.c. water. Each of 9 holes 4 inches deep made equidistant over the surface received 20 c.c. of this emulsion, none of the holes being directly over a wireworm cage. Where no further water was added, the kill was 100 per cent. at the 4 inch level, 97 per cent. at 9 inches and 47 per cent. at 12 inches, but where 6 U.S. gals. water was added to the surface, the kill was considerably less at all depths.

As a large part of the wireworm infested soil in southern California is irrigated, it was thought that if a toxic agent could be added to the water at the time it was run on the land, a cheap and efficient method of application and spreading would be available. Experiments were therefore carried out by placing the chloropicrin emulsion in water, applying the solution to the surface of the soil and allowing it to soak in. When 20 c.c. chloropicrin, 20 c.c. soap and 5 U.S. gals. water was used and the soil was firmly packed into all parts of the vat so that penetration was uniform, 100 per cent. of the larvae were killed at 2 and 6 inches, and 72 and 46 per cent. at 8 and 12 inches respectively. In further experiments with varying quantities of water, mortality invariably amounted to 100 per cent. at the 4 inch depth, but at the 8 and 12 inch depths the percentage was higher with the larger quantity (8 U.S. gals.) of water. Attempts to apply chloropicrin to the soil

without emulsifying it gave less satisfactory results. Additional tests in a typical wireworm infested field in which the screen-wire cages were packed gave 100 per cent. mortality at the 4 inch depth, but as the solution descended and the quantity in the soil became less, the mortality decreased accordingly. Comparative tests with carbon bisulphide showed it to be very much less effective. Liquid hydrocyanic acid in water did not kill quite so high a percentage of wireworms as did chloropicrin, probably owing to the high volatility of the former, much of which is lost by evaporation.

As 25·6 U.S. gals. chloropicrin would have to be applied to the acre to obtain satisfactory control, it would be too expensive except in the case of very valuable crops. Trials with young plants and germinating seeds indicated that the dilute solutions were not injurious to them.

LEHMAN (R. S.). **Field Experiments with various Poison Baits against Wireworms** *Limonius* (*Pheletes*) *canus* **Lec.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 243–252. Geneva, N.Y., February 1933.

The following is taken from the author's abstract and conclusions: Approximately 125 organic and inorganic compounds were employed at different concentrations in ground whole-wheat baits to determine their effect on the wireworm, *Pheletes* (*Limonius*) *canus*, Lec., along the northwestern Pacific Coast of the United States. Arsenic compounds were found to be definitely repellent. It does not appear from the experiments that the use of poison baits would be a very efficient method of wireworm control on a large scale. In a plot where the soil was first sifted to determine the wireworm population and where baits were afterwards placed in the soil a foot apart, a second sifting showed that the wireworm population had been reduced about 50 per cent. To obtain 50 per cent. of the larvae, however, the baiting must be done at the most favourable time, when the soil is warm and the larvae near the surface. The only poison that showed any promise was paraphenylenediamine.

RICHARDSON (H. H.). **Extractive Efficiency of Kerosene on Pyrethrum Powders of varying Fineness.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 252–259, 1 fig., 11 refs. Geneva, N.Y., February 1933.

The following is the author's abstract: The extractive efficiency of kerosene on pyrethrum powders of varying degrees of fineness was tested by comparing the insecticidal efficiency of such extracts with standard extracts of pyrethrum containing 50, 75 and 100 per cent. of the active constituents. The time, in seconds, until 50 per cent. of the flies used in insecticidal tests were paralysed was taken as the main criterion for determining insecticidal power. Mortality data were taken, but as previously reported [*R.A.E.*, A, xix, 344], the percentage kill was not a sufficiently sensitive index to indicate the small differences in the pyrethrin content of kerosene extracts. The efficiency of extraction on 12–15, 20, 30 and 45 mesh pyrethrum powders was about the same in each case; it is estimated that 80 per cent. of the active constituents was obtained. Extraction of 200 mesh pyrethrum powder was more efficient, however, giving approximately 90 per cent. of the active constituents. Apparently the achenes or seeds, which contain a very large percentage of the active constituents, are not thoroughly crushed in powders varying from 12 to 45 mesh, whereas with 200 mesh

powder the achenes are entirely broken up. This difference might account for the observed difference in the extractive efficiency of kerosene on these various grades of powder.

Crumb (S. E.) & Chamberlin (F. S.). **A Comparison of the Effectiveness of sustained Vacuum and dissipated Vacuum in Fumigation with Hydrocyanic Acid Gas.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 259–262. Geneva, N.Y., February 1933.

In the course of experiments in the fumigation of cigars with hydrocyanic acid gas for the destruction of *Lasioderma serricorne*, F., tests were carried out to compare the effectiveness of sustained and dissipated vacuum in fumigation. In the sustained vacuum experiments liquid HCN was drawn into the evacuated chamber through a vaporising nozzle, and no air was admitted except the small amount drawn in with the liquid. The period of exposure, which was 4 hours in each case, was reckoned from the time the gas was admitted. In the dissipated vacuum experiments the fumigant was similarly admitted, but after a period of 15–20 minutes had been allowed for volatilisation, a large air valve was opened and the air was allowed to rush in until the vacuum was completely dissipated. The period of exposure in this case was reckoned from the time the large air valve was opened, thus allowing slightly longer actual exposure. Larvae and pupae of *L. serricorne* were placed in gelatine capsules partly filled with a firm wad of tobacco, in which the larvae were allowed to become established before fumigation, several holes being punched in the cap of each capsule. Two of these capsules were then rolled into each of a number of cigars, and these were placed in the bottom row of a loosely filled box, the lid of which was held slightly open by the insertion of a match stick. The box was placed on a grating near the bottom of the fumigation chamber, and at the end of treatment the capsules were removed and kept under conditions favourable for the survival of the beetles. Examination six days after treatment showed 17·5 per cent. less mortality at doses of from 15 to 20 oz. of the fumigant per 1,000 cu. ft. from dissipated vacuum fumigation than was obtained in the sustained vacuum experiments. At dosages of from 1·5 to 3·5 lb. the dissipated vacuum fumigations showed 0·48 per cent. less mortality for larvae and 16·3 per cent. less mortality for pupae.

Cupples (H. L.). **A Consideration of "Interval Shooting" as practiced in Citrus Fumigation.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 262–269, 6 figs., 2 refs. Geneva, N.Y., February 1933.

An attempt is made, by means of mathematical formulae and diagrams, to show that the more recent practice of introducing hydrocyanic acid into the fumigation tent for the control of Coccids on *Citrus* in two or more individual portions with a chosen time interval between the additions is less advantageous than the usual procedure of introducing the entire charge of fumigant at the beginning of the fumigation period.

Gaines (J. C.). **Reliability of Differences between Data obtained in Cotton Insect Investigations.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 274–279, 2 refs. Geneva, N.Y., February 1933.

The following is taken from the author's abstract and summary: A statistical comparison is made of the methods used in taking samples

of cotton insect infestations and in obtaining data on the growth of cotton plants in experimental plots. The results indicate that the mean difference between the point and survey methods used in estimating infestation by the boll weevil [*Anthonomus grandis*, Boh.] is not significant. The mean difference between the sweeping and examination methods used to estimate the population of the cotton fleahopper [*Psallus seriatus*, Reut.] is significant. The number of insects taken in 100 sweeps is not as good a sample of the population in the buds of 100 plants as the number of insects recorded by the examination method. The mean difference between the average plant height records taken on 100 plants at each of three points and the average plant height records taken on 100 plants at one point in experimental plots is not significant.

HOLLOWAY (J. K.). **Shipping Adult Insect Parasites in refrigerated Containers.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 280–282, 1 pl., 1 ref. Geneva, N.Y., February 1933.

A refrigerated container devised to decrease the mortality in shipments of parasites has been used successfully in transporting frail adult stages of several species of parasites of *Cydia* (*Grapholitha*) *molesta*, Busck (oriental fruit moth) to practically all the peach-growing centres in the eastern part of the United States. A maximum of 500 adults were confined in wooden cages having a capacity of 300 cubic inches and provided with a water bottle having a cotton plug stopper covered with gauze. The water was fed to the stopper by a gauze wick. About 1 gm. of food made of honey and sugar was supplied, the quantity of sugar being sufficient to make the mixture almost dry. The surface area within the cage was increased by tacking cloth to opposite sides and weaving it between three wire supports. Up to 4 such cages were packed with dry sphagnum moss in a metal cylinder with a tight-fitting telescopic lid. The cylinder was placed upright in a 40 U.S. quart ice-cream shipping tub, at the bottom of which 8 inches of sawdust was placed before any ice was added. This prevents stratification of the air within the cylinder and excessive variation in temperature between the top and bottom of the container. The pieces of ice were as large as possible and were mixed with sawdust to prolong refrigeration and avoid too low a temperature resulting from rapid melting. The container, completely packed with 50 lb. ice, had an average gross weight of 145 lb. A test under average shipping conditions showed that for the greater part of 55 hours the temperature of all parts of the refrigerated portion was within a desirable range for the cold storage of adult parasites, lying between 40 and 60·7°F. In another experiment in which two colonies of 1,000 adults of *Macrocentrus ancylivora*, Roh., were packed and allowed to remain for 60 hours, when the container was unpacked the temperature in the cylinder was 44°F. and there was no mortality. Shipments were made throughout the entire summer of 1931, the average consignment being in transit 50 hours and the average mortality of *M. ancylivora* being only 1·4 per cent.

CLAASSEN (P. W.). *Draeculacephala mollipes* **Say, a Cicadellid Pest of Apples.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 282–284, 1 pl. Geneva, N.Y., February 1933.

Injuries of a type not hitherto reported caused to the fruit and twigs of apple by crescent-shaped oviposition punctures of *Draeculacephala*

mollipes, Say (sharp-nosed leafhopper) were observed in several orchards in New York State. The females make a curved cut, 3–4 mm. long, through the skin of the apple or twig, and deposit up to 20 eggs within each puncture. As many as 125 punctures were found on a single apple, and apples with 25–40 punctures were very common. Punctures on twigs occurred frequently at the rate of 5–7 to a linear inch, the scars being severe and persisting for years. The injury was largely restricted to the lower portion of the tree, the greatest number of egg punctures being found on apples and twigs within 2–4 ft. of the ground. Oviposition was rarely observed on apples lying on the ground. Apples with oviposition punctures are subject to rather rapid drying out, and at ordinary room temperatures they soon begin to shrivel up and eventually rot. Affected apples stored at 33°F. kept well during the winter, but by 1st March many had begun to rot and fungus growth was observed in the oviposition punctures. More than 30 varieties of apple were attacked and all appeared equally susceptible. In all orchards where injury was observed the ground was well covered with grass and weeds.

Spies (J. R.). **The Toxicity of certain Plant Extracts to Goldfish. II.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 285–288, 1 ref. Geneva, N.Y., February 1933.

Further determinations of the toxicity to goldfish of acetone extracts of certain reputedly poisonous plants have been made [*cf. R.A.E.*, A, xx, 295]. Preliminary toxicity tests have been made on various types of insects with those acetone extracts that killed goldfish in an average of 150 minutes or less. The results indicate that a few of them possess insecticidal value, and data secured in more complete tests of this nature will be presented later.

Hutson (R.). **Propylene Dichloride as a fumigating Material.**—*J. Econ. Ent.*, xxvi, no. 1, p. 291. Geneva, N.Y., February 1933.

Tests with propylene bichloride against various grain-infesting insects have shown that mixtures of this material can be considered as efficient as carbon bisulphide for fumigation, without the fire hazard attending the use of the latter material, the prices of the two being comparable.

Bailey (S. F.). **The Gladiolus Thrips, *Taeniothrips gladioli* M. & S., in California.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 291–292. Geneva, N.Y., February 1933.

Taeniothrips gladioli, Moult. & Stnw., which has recently become a pest of *Gladiolus* in the eastern and middle western United States and in Canada, was found during 1932 in about 50 localities in southern and central California. All the collections were from *Gladiolus*, many of the infestations in the south being rather severe.

Hopper (T. H.). **Arsenic in Bait-poisoned Grasshoppers.**—*J. Econ. Ent.*, xxvi, no. 1, p. 292, 1 fig. Geneva, N.Y., February 1933.

Analysis of grasshoppers that had been sorted approximately according to 3 sizes, $\frac{1}{2}$, $\frac{3}{4}$ and 1 inch in length, after feeding on a bait consisting of 5 lb. arsenic to 100 lb. bran, showed that it would require 410, 304 or 259 grasshoppers according to size to yield 1 grain of arsenic.

Probably owing to their large feeding capacity more arsenic was consumed than should be necessary to kill. The quantity of poison found per grasshopper (0·158, 0·213 and 0·250 mg.) was somewhat proportional to size and feeding capacity. The results indicate that the standard bait is attractive and palatable to the grasshoppers, and that it is an economy to poison them while they are young and small.

KEIFER (H. H.). *Abia americana* **(Cresson) on** *Lonicera.*—*J. Econ. Ent.*, xxvi, no. 1, p. 293. Geneva, N.Y., February 1933.

Infestations by the Tenthredinid, *Abia americana*, Cress., records of the food-plants and life-history of which do not appear to be readily available, were observed in Sacramento, California, on 12th April 1930 on cultivated climbing honeysuckle (probably *Lonicera japonica*), and on 20th April 1932 on hedge *Lonicera* of the *nitida* type. Larvae of the second lot fed for about 10 days after collection before forming cocoons on the sides of the bottle and soil surface. Adults emerged on 20th November 1932 from cocoons in a bottle that had been placed in the refrigerator on 20th June at 40–45°F. and removed on 9th November. This appears to indicate that *A. americana* is single brooded and that the larvae require low temperature to prepare them for pupation.

HOFFMAN (W. A.). *Rhizopertha dominica* **as a Library Pest.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 293–294. Geneva, N.Y., February 1933.

The Bostrychid, *Rhizopertha dominica*, F., is recorded as causing injury to books in a library in Porto Rico, in which it had been present for several years. The beetles mainly confined their activity to the inner portion of the backs of the books, causing the binding to become loose and less durable. The library, which occupies 10,320 cu. ft., was fumigated for 36 hours with 5 lb. calcium cyanide dust spread over a newspaper and placed on the floor, the doors and windows having been sealed with adhesive paper, but though many larvae and adults were killed, the beetles had become as numerous as ever a few months later. In the following year the treatment was repeated with a double quantity of the fumigant, and six months later there was no evidence of the presence of any of the beetles.

LEONARD (M. D.). **A Braconid Parasite of a Coccinellid new to Puerto Rico.**—*J. Econ. Ent.*, xxvi, no. 1, p. 294. Geneva, N.Y., February 1933.

Investigation of an outbreak of *Sipha flava*, Forbes, on young plant sugar-cane in Porto Rico showed heavy infestation in spite of the presence of the predator, *Cycloneda sanguinea*, L., in numbers throughout the planting. Pupae of this Coccinellid were unusually numerous on the leaves, but 90 per cent. were dead and bore signs of parasitism. A few parasites obtained from them proved to be the Encyrtid, *Homalotylus terminalis*, Say, and a Pteromalid.

CRESSMAN (A. W.). **Control of an Infestation of the Cigarette Beetle in a Library by the Use of Heat.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 294–295, 1 ref. Geneva, N.Y., February 1933.

An account is given of the eradication by means of heat of *Lasioderma serricorne*, F., in a library in New Orleans where the use of hydrocyanic acid gas was impracticable. A gas burner with a capacity of 2½ cubic

feet per minute was installed, and a temperature of 140–145°F. was maintained for 6 hours, even distribution in the room, which measured 100 by 21 by 15 ft., being secured by electric fans. The outside temperature for the day of treatment varied between 78 and 94°F. with a mean of 86. The books, which had been badly injured in all parts of the library, were loosened to allow the air to circulate round them. Examination 3 days after treatment showed many dead larvae, pupae and adults, but neither then nor 37 days later were any living insects found. As the longest incubation period of *L. serricorne* has been shown to be 14 days, the absence of living larvae at the second inspection indicates that the eggs also were killed. Both the books, which were bound in buckram and sheepskin, and wooden furniture left in the room withstood the heat without injury.

METZGER (F. W.) & SIM (R. J.). **Coleoptera captured in Japanese Beetle Traps.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 296–297. Geneva, N.Y., February 1933.

A list is given of 38 species of beetles, including several of economic importance, captured, sometimes in large numbers, between 25th and 30th June 1932 in traps set for the Japanese beetle [*Popillia japonica*, Newm.] in New Jersey.

KEEN (F. P.). **A Note on the Hibernation Habits of some Engraver Beetles of the Genus** *Ips*.—*J. Econ. Ent.*, xxvi, no. 1, pp. 297–298. Geneva, N.Y., February 1933.

Though bark-beetles usually hibernate under the bark of the trees they have infested as larvae, this habit is not universal. In the course of recent studies of the seasonal history of *Dendroctonus brevicomis*, Lec., infesting *Pinus ponderosa* in Oregon, a rather heavy emergence of *Ips emarginatus*, Lec., and *I. oregoni*, Eichh., was observed during October and through early November in cages applied to the trunks of infested pines. Their habit appeared to be to leave the bark in autumn, drop straight to the ground and seek shelter at the base of the trees. Examination of the soil showed a large number of beetles of both species at the ground level and to a depth of 3 inches below, hibernating in the outer bark flakes and crevices. Many adults, however, were also found hibernating in the old tunnels in the bark of the trees. A habit that has been noted for *I. confusus*, Lec., in single leaf pinon (*Pinus monophylla*), *I. radiatae*, Hopk., in lodgepole pine (*P. contorta*) and *I. vancouveri*, Sw., in white pine (*P. monticola*), and which is probably characteristic of other species of the genus, is for the hibernating new adults to congregate in large groups under the bark by chewing away the partitions between their pupal chambers.

Other secondary insects emerging in large numbers from the bark late in November and probably hibernating in the ground included adults of the Staphylinid, *Nudobius pugetanus*, Csy., *Rhizophagus sculpturatus*, Mann., the Colydiids, *Lasconotus complex*, Lec., *L. subcostulatus*, Kraus, and *Aulonium longum*, Lec., and the Tenebrionid, *Hypophloeus substriatus*, Lec. The most abundant larvae emerging at this time included those of an undetermined Cecidomyiid and of the Clerid, *Thanasimus nigriventris*, Lec. (*Enoclerus lecontei*, Wolc.). The latter build silk-lined pupal cells at the ground line or below. From a total of 16 cages not a single example of *D. brevicomis* was collected, although all the cages were over bark primarily infested by this beetle,

SCOTT (F. T.). **Notes on a Coccinellid** (*Hyperaspis 8-notata* **Casey) predacious on Citricola Scale** (*Coccus pseudomagnoliarum* **Kuwana) in Tulare County, California.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 298–299. Geneva, N.Y., February 1933.

The larvae of *Hyperaspis octonotata*, Csy., were first observed in Tulare County, California, in May 1929, when they were taken in an abandoned orange grove infested with *Coccus pseudomagnoliarum*, Kuw. Brief descriptive notes are given to facilitate the identification of this Coccinellid and several accounts of collections are recorded. It was taken in 1928 feeding in large numbers on *Physokermes insignicola*, Craw (Monterey pine scale) on Monterey Peninsula. Part of an orange grove where the Coccinellid was found for the first time in the spring of 1931, and where the adult population increased in some cases to as many as 200 to a tree by July, was left unsprayed in order to determine its value in controlling *C. pseudomagnoliarum*, of which, with the exception of *Chilocorus stigma* (*bivulnerus*) var. *orbus*, Csy., it appears to be the only Coccinellid predator, at least in the San Joaquin Valley.

METZGER (F. W.). **The Toxicity of the Common Castor-bean Plant in Respect to the Japanese Beetle.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 299–300. Geneva, N.Y., February 1933.

Observations and tests in New Jersey in 1932 showed that adults of *Popillia japonica*, Newm., feed on some varieties of *Ricinus communis* though others are practically immune. There was some evidence that the beetles were killed by feeding on castor foliage under certain field conditions, but in a cage experiment it was practically non-toxic. The tests, however, proved conclusively that castor is of little or no value as a trap plant under usual field conditions, heavy infestations being noted only after the height of the beetle season, when favourite food-plants had already been severely injured.

STANLEY (W. W.). **Outbreak of Grasshoppers in Tennessee during 1932.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 300–301. Geneva, N.Y., February 1933.

Grasshoppers were present in injurious numbers for the first time in Tennessee in 1932, *Schistocerca americana*, Drury, being the most common species and causing most of the losses, particularly in maize and other field crops *Melanoplus femur-rubrum*, DeG., was less abundant and was usually found in pastures and lucerne fields. Other species were more abundant than usual, but of comparatively little importance. A single experiment under field conditions was carried out on 16th September 1932 with *M. femur-rubrum* to determine the best formula for poison bran mash and the temperatures favourable for feeding. On a basis of 100 lb. bran and 10 U.S. gals. water, various materials were added as follows: 4 lb. poison, 2 U.S. gals. molasses and 3 fl. oz. amyl acetate. The formula containing sodium fluosilicate, amyl acetate and molasses gave the best results, sodium fluosilicate alone coming second and Paris green, amyl acetate and molasses third. The remaining formulae were much less efficient, but the data showed that baits containing sodium fluosilicate attracted more grasshoppers than those containing Paris green. Richardson and Haas [*R.A.E.*, A, xx, 695] found that grasshoppers allowed to feed on poisoned bait consumed about twice as much of baits containing sodium fluosilicate

as of those containing the sodium arsenites or Paris green, although the median lethal dose was about the same for all three. Sodium fluosilicate appears to be fully as effective in poison baits as Paris green and is much safer to handle. The addition of amyl acetate to baits containing molasses added to their attractiveness.

Observations showed that for the optimum feeding period soil temperatures ranged from 80 to 109°F., air temperatures (not in shade) 12 inches above ground level from 72 to 91°F., and air temperatures 30 inches above ground level from 72 to 88°F. A parasitic fly, tentatively identified as *Sarcophaga aculeata*, Aldr., was fairly abundant.

De Eds (F.). **Comparative Toxicities, with special Reference to Arsenical and Fluorine-containing Insecticides.**—*J. Econ. Ent.*, xxvi, no. 1, pp. 302–304, 3 refs. Geneva, N.Y., February 1933.

The question of the comparative toxicity to man of substances used as insecticides is discussed. The procedure for obtaining comparative data on acute toxicity is fairly simple, but comparison of the ability of two or more substances to produce chronic intoxication is more difficult and less satisfactory. The fundamental points that should be observed in making comparative studies are outlined. Recent work on the comparative chronic toxicity to mammals of arsenical and fluorine insecticides is briefly reviewed [*R.A.E.*, A, xx, 299, 649].

In view of the wide variation in different species of animals in susceptibility to toxicity of a given agent, and in view of the extremely low concentrations of fluorine in the drinking water of St. David, Arizona, an endemic area for mottled teeth, it would not be surprising to find that in man the margin of safety for fluorine insecticides is no greater than for arsenical materials. Until the lowest possible threshold tolerance for fluorine compounds has been established, and until the fullest use has been made of information to be gleaned from areas where mottling of the teeth is endemic, the question of the wisdom of substituting fluorine-containing insecticides for lead arsenate must remain an open one.

Lepigre (A.). **Note sur l'apparition en Algérie de** *Schedius* (*Ooencyrtus*) *kuwanae* **How. (Hym. Encyrtidae).**—*Bull. Soc. Hist. nat. Afr. N.*, xxiii, no. 8, p. 227. Algiers, November 1932. [Recd. March 1933.]

Considerable numbers of the Encyrtid, *Ooencyrtus* (*Schedius*) *kuvanae*, How., were bred at Algiers in 1931 and 1932, from eggs of *Porthetria* (*Lymantria*) *dispar*, L., collected near Bône, on the north-eastern coast of Algeria.

de Bergevin (E.). **Note à propos de cas d'hybridation constatés entre** *Oxycarenus lavaterae* **F. et** *Oxycarenus hyalinipennis* **Costa (Hémiptères Lygaeidae) et description d'une nouvelle espèce d'***Oxycarenus* **provenant du Sud-tunisien.**—*Bull. Soc. Hist. nat. Afr. N.*, xxiii, no. 8, pp. 253–256, 1 fig. Algiers, November 1932. [Recd. March 1933.]

The author has found *Oxycarenus lavaterae*, F., to be common on *Hibiscus* in gardens and parks in Algeria and Tunisia, and in an instance in which it occurred on *Althaea rosea* together with *O. hyalinipennis*, Costa, he observed that pairing took place between the two

species, the females usually belonging to the former and the males to the latter. Two months later he found adults that showed definite hybrid characters. *O. castaneus*, sp. n., is described from southern Tunisia.

Flint (W. P.) & Metcalf (C. L.). **Insects, Man's Chief Competitors.**—Cr. 8vo, viii+133 pp., 9 figs., 3 pls. Baltimore, The Williams & Wilkins Co.; London, Baillière, Tindall & Cox, 1932. Price 5*s*. 6*d*. [Recd. April 1933.]

This popular hand-book comprises a general survey of the habits of insects and their importance as pests of man, animals and agricultural crops, chiefly with reference to the United States, followed by brief accounts of a few individual groups or species.

Ryall (A. L.) & Fahey (J. E.). **The Effect of Fish Oil Sprays on Spray Residue Removal. (A Preliminary Report.)**—*Northwest Fruit Grower*, p. 4, August 1932. [Recd. March 1933.]

In further experiments in the removal of arsenical residues from apples sprayed with lead arsenate and fish-oil [*cf. R.A.E.*, A, xx, 279], solutions of sodium carbonate or other alkalis in concentrations of 60–80 lb. to 100 U.S. gals., at 90–110°F., left only 0·005 grain of As_2O_3 per lb. of fruit, as against more than 0·01 grain left after washing with 1 per cent. hydrochloric acid solution alone or in combination with 1½ per cent. kerosene emulsion.

Cupples (H. L.). **Equipment for Laboratory Fumigations with Hydrocyanic Acid, with controlled Temperature and Humidity.**—*Industr. Engng. Chem.*, Anal. edn., v, pp. 36–38, 3 figs., 3 refs. Easton, Pa., 15th January 1933.

An apparatus is described that has proved satisfactory for use in laboratory experiments relating to the toxicity of hydrocyanic acid gas to *Chrysomphalus aurantii*, Mask. [*cf. R.A.E.*, A, xx, 32]. Provision is made for controlling the concentration of the gas, relative humidity, time and temperature.

Cupples (H. L.). **Determination of Hydrocyanic Acid in Air and Air-Carbon Dioxide Mixtures.**—*Industr. Engng. Chem.*, Anal. edn., v, pp. 50–52, 3 figs., 2 refs. Easton, Pa., 15th January 1933.

An apparatus is described for testing the concentration of hydrocyanic acid gas in tent fumigation by analysis of successive samples of the gas. In a typical fumigation an initial concentration of about 15 mg. per litre was reduced to 1 mg. in about 17 minutes.

Hutson (R.). **Japanese Beetle,** *Popillia japonica*.—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 3, pp. 166–168, 1 fig. East Lansing, Mich., February 1933.

In the summer of 1932 a few individuals of *Popillia japonica*, Newm., were found for the first time in Michigan. Brief notes are given on its bionomics and control.

McDaniel (E. I.). **Gladiolus Thrips,** *Taeniothrips gladioli.*—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 3, pp. 168–172, 1 fig. East Lansing, Mich., February 1933.

A brief account is given of the bionomics of *Taeniothrips gladioli*, Moult. & Stnw., on *Gladiolus* in Michigan [*cf. R.A.E.*, A, xx, 420]. The measures recommended include: fumigating the stored corms for 2–3 weeks with naphthalene flakes (1 oz. to 100 corms) in trays under canvas; immersing the corms for 2–3 hours in mercury bichloride (1 oz. to 8 U.S. gals. water); and applying a spray 3 or 4 times on alternate days to the growing plants after all flowers have been removed. Of the sprays used the most satisfactory was composed of 3½ oz. lead arsenate, 4 oz. derrisol and 1 lb. glue to 10 U.S. gals. water.

Lathrop (F. H.) & Newton (R. C.). **The Biology of** *Opius melleus*, **Gahan, a Parasite of the Blueberry Maggot.**—*J. Agric. Res.*, xlvi, no. 2, pp. 143–160, 6 figs., 10 refs. Washington, D.C., 15th January 1933.

An account is given of the results of laboratory and field studies conducted in 1925–29 in eastern Maine on the bionomics of the Braconid, *Opius melleus*, Gah., as a parasite of the blueberry maggot, *Rhagoletis mendax*, Curran (*pomonella*, auct.) [*cf. R.A.E.*, A, xx, 464]. A biological strain of this parasite, the individuals of which are distinctly larger, infests the typical *R. pomonella*, Walsh, on apple. The life-cycle of *O. melleus* closely follows that of its host on blueberry [*cf.* xii, 7], with a lag of 10–15 days in its curve of emergence. The full-grown larvae overwinter in the host puparia, about 1½ inches below the surface of the soil, both species sometimes remaining at this stage over 2 or more years. The adult parasites emerge in July or August, about 30 days after pupation. Of all the adults taken, only 37·68 per cent. were females. The female oviposits, probably 10–13 days after emergence, in late 2nd or 3rd instar larvae, lodged under the skin of the blueberries. After an incubation period of probably 3–6 days, the larva normally remains in the 1st instar till the host puparium is formed, after which it generally reaches its 4th instar within 10 days. More than one egg was frequently found in the same host larva, but never more than one mature parasite larva in a host puparium. The determination of the total rate of parasitism presented many difficulties, and no quite satisfactory method was found. A comparison between the numbers of *O. melleus* and of 3rd instar host larvae throughout the season suggested that parasitism amounted to nearly 50 per cent.

Ginsburg (J. M.). **The Effect of different Soaps on Lead Arsenate in Spray Mixtures.**—*J. Agric. Res.*, xlvi, no. 2, pp. 179–182, 5 refs. Washington, D.C., 15th January 1933.

Soap, the cheapest and most efficient spreader for use in lead arsenate sprays, has been found to liberate soluble arsenic injurious to foliage [*R.A.E.*, A, xi, 393]. It has been shown, however, that the amount liberated varies when different fatty acids are used in the soap [xii, 194] and this suggested that soaps consisting of the same fatty acid but of different bases might exhibit even greater differences in their action. In order to test the effects of different soaps, apple trees were sprayed 3 times with a mixture containing 3 lb. lead arsenate, 4 lb. ferric oxide,

added as an adhesive and corrective [xix, 546], and 0·5 per cent. soap to 100 U.S. gals. spray. Mixtures were made with commercial potash fish-oil soap and with 2 soaps prepared from pure oleic acid and potassium or the organic base triethanolamine, $(CH_2CH_2OH)_3N$. The first caused about 30 per cent. defoliation; the second produced some brown patches on the leaves; the third caused very slight damage, and not before the third application. A similar spray with no soap caused no visible damage.

In laboratory tests, mixtures of acid lead arsenate and distilled water, at a concentration equivalent to 3 lb. to 100 U.S. gals., with the fish-oil soap and with oleates of sodium, potassium, ammonium and triethanolamine were allowed to stand for 24 hours. When the percentage of soap was 0·5, the percentage residues of soluble As_2O_3 were respectively 20·87, 10·8, 9·78, 6·67 and 4·63, as against 0·43 when no soap was included. The amount of lead arsenate decomposed was not in direct proportion to the amount of soap present in solution, so that the reaction is probably one of double decomposition. Evidently the hydrated ferric oxide used in the field tests was not sufficient to neutralise the soluble arsenic liberated by the soap prepared from a strong base (potassium), still less that liberated by the fish-oil soap. It follows that soap, if used at all, should be prepared from pure oleic acid and a weak base.

Miller (R. L.), Bassett (I. P.) & Yothers (W. W.). **Effect of Lead Arsenate Insecticides on Orange Trees in Florida.**—*Tech. Bull. U.S. Dept. Agric.*, no. 350, 20 pp., 8 figs., 17 refs. Washington, D.C., February 1933.

An account is given of investigations in Florida to determine the effect on *Citrus* fruits and trees of the application of lead arsenate as used in bait-sprays against *Ceratitis capitata*, Wied., during the recent eradication campaign. The following is almost entirely taken from the authors' summary: In experiments on the effect of the drip of arsenic on the soil beneath the trees, 60 applications of ½ lb. lead arsenate in 7½ U.S. gals. water applied to the soil at intervals of 1–2 weeks over a period of 1½ years produced no noticeable results on the fruit, tree or undergrowth of a grapefruit tree. Arsenic trioxide in the proportion of 2,000 parts per million was present in the first 2 ins. of soil, whereas the leaves contained only a trace, and after an additional year it was present in the soil at the rate of 1,800 parts per million, the fruit, tree and undergrowth still being normal. The application of 14 sprays to a seedling orange had no injurious results, though arsenic trioxide was present in the soil at the rate of 700 parts per million.

When lead arsenate was sprayed on orange leaves, a diminishing supply of arsenic soluble and insoluble in water was present for a year after; a tree treated with 8 lb. lead arsenate to 200 U.S. gals. syrup-sugar mixture showed 0·34 mg. soluble arsenic as arsenic trioxide and 2·76 mg. insoluble arsenic on 10 gm. green leaves immediately after spraying, which after 6 months had decreased to 0·005 and 0·19 mg. respectively. Arsenic was evidently transported to the wood, blossoms and small fruit, in which analysis revealed quantities ranging from a trace to 6·9 mg. arsenic trioxide per kg. of sample. The presence of soluble arsenic (measured as arsenic trioxide) on the leaves at the rate of 0·01 mg. per 10 gm. leaves stimulated respiration and catalase activity; at the rate of more than 1 mg. to 10 gm. leaves respiration increased

50–75 per cent. above the normal, the leaves usually falling, and the catalase activity decreased until it was almost stopped.

When arsenic was present on the leaves, less acid was produced in the fruit and what was formed disappeared more rapidly than on unsprayed trees. When as much as 0·01 mg. total arsenic trioxide was present on 10 gm. green leaves at maturity, the maximum reduction without injury to the tree in fruit acid was produced. The hydrogen-ion concentration of fruit juice from sprayed trees was lower than that from unsprayed ones. An increase occurred in the solids of fruit juice when as little as 0·008 mg. arsenic trioxide was present, but a decrease resulted from a greater amount. The ratio of acids to solids was markedly affected by arsenic on the leaves; a slight increase over 0·01 mg. arsenic trioxide per 10 gm. leaves caused the ratio to rise from slightly above the normal to 20 : 1. When sufficient arsenic was present to cause the leaves to fall, the arsenic was eliminated from the tree and the fruit was less affected. A maximum of 0·16 mg. arsenic trioxide per litre juice was found in fruit from trees receiving a total of 17 applications of 5 U.S. gals. bait-spray at intervals of 10 days.

Experiments proved that the effect of arsenic is not systemic, only the sprayed part of the tree being affected. The result of spraying is shown almost immediately and persists to a slight degree for about 18 months but has disappeared after 2½ years.

GAINES (J. C.). **Trap Collections of Insects in Cotton in 1932.**—*Bull. Brooklyn Ent. Soc.*, (N.S.) xxviii, no. 2, pp. 47–54, 1 pl. Brooklyn, N.Y., 1933.

In Texas in 1932 insect injury to cotton occurred throughout the whole season. Early in the spring the seedlings were attacked by thrips, and in June and July Rhynchota, of which *Psallus seriatus*, Reut., and *Adelphocoris rapidus*, Say, were the most important, became abundant, causing an excessive shedding of squares. *Heliothis obsoleta*, F., and *Alabama argillacea*, Hb., attacked both the fruit and foliage during July and August, and *Anthonomus grandis*, Boh., which was numerous in early September, infested practically all the squares.

A list is given of 199 species, representing 61 families, of insects trapped in a cotton field during the period from mid-June to the end of August. The trap consisted of two pieces of screen wire tacked to frames, which were nailed together to form a right angle and attached to three poles fixed in the ground in a triangle, so that the bottom edges of the frames were about three feet above the ground. The wire was thickly coated at regular intervals with an adhesive.

Service and Regulatory Announcements July-September 1932.—*U. S. Dept. Agric.*, *B.P.Q.*, S.R.A., no. 112, pp. 51–92. Washington, D.C., December 1932.

Recent revisions and amendments to existing quarantine orders of the United States are given verbatim. A press notice relating to the gipsy moth [*Porthetria dispar*, L.] quarantine (No. 45) announces the discovery of the presence of the moth in Pennsylvania in July 1932. The information available indicates that an area about 8 miles long and 4 miles broad is already involved, and that the moth has been present for about 15 years. As there are no nurseries in this area, no shipments

of plants or trees have been made from it. Eradication measures will be undertaken without delay, and the chances of extermination appear hopeful.

An announcement (B.P.Q. 337) regarding the narcissus bulb quarantine (No. 62) includes instructions for the treatment of bulbs infested with *Merodon equestris*, F. (without Nematodes). The bulbs may be fumigated for 4 hours at a temperature of 60°F. or more in an air-tight chamber, requirements for which are defined, with either calcium cyanide (slowly evolving type) at the revised rate of 16 oz. to 100 cu. ft. [*cf. R.A.E.*, A, xvii, 163, 382], or with a mixture consisting of 7 oz. sodium cyanide (50 per cent. cyanogen), 10½ oz. sulphuric acid (66°B.) and 14 oz. water to 100 cu. ft.; or they may be subjected to treatment with water at 110–111·5°F. for a period of 1 hour computed from the time the water regains the loss of temperature occurring when the bulbs are submerged.

DU PASQUIER (R.). **Principales maladies parasitaires du théier et du caféier en Extrême-Orient.**—*Bull. écon. Indochine*, xxxv, pp. 689B–720B, 10 figs., 5 pls., 38 refs. Hanoi, 1932. [Recd. March 1933.]

This paper, the fourth of a series [*R.A.E.*, A, xxi, 147, etc.], deals with Coccids, thrips, mites and Nematodes. The chief Coccids occurring in Indo-China are: *Coccus* (*Lecanium*) *viridis*, Green, which is present throughout the year on both tea and coffee, but is especially harmful to the latter; *Saissetia coffeae*, Wlk. (*L. hemisphaericum*, Targ.), which attacks coffee but is considerably less common, whereas in India and Java it also infests tea, sometimes severely; *Pseudococcus citri*, Risso, of which the aerial form is confined to Arabian coffee, whereas the more injurious root form causes serious damage to both the Arabian and Liberian varieties; *Pinnaspis* (*Chionaspis*) *theae*, Mask., which occurs on tea only, outbreaks being rare and localised, whereas in India and Ceylon they are very severe; and an unidentified black scale, which is common in winter on the leaves and branches of isolated tea plants, the male not having been found. The only thrips that are pests are those attacking tea; they include *Physothrips setiventris*, Bagn., in India, *Anaphothrips theifolii*, Karny, *A. theivorus*, Karny, and *A. theiperdus*, Karny, in Ceylon, and an unidentified yellow species, an outbreak of which occurred in Tonkin in 1931. Of the mites, all of which infest tea, only *Tetranychus* (*Paratetranychus*) *bioculatus*, W. M., and *Eriophyes* (*Phytoptus*) *carinatus*, Green, occur in Indo-China, where they cause severe damage. Both these species, as well as *Brevipalpus* (*Tenuipalpus*) *obovatus*, Donn., *Tarsonemus translucens*, Green, and *Eriophyes* (*Phytoptus*) *theae*, Watt, occur in India, Java and Sumatra, *B. obovatus*, *T. translucens*, *E. carinatus* and *Tetranychus bioculatus* being also found in Ceylon and the last-named in Japan.

Coloured illustrations are given of all the Coccids mentioned above, as well as of the unidentified thrips, *T. bioculatus* and *E. carinatus*.

GONGGRIJP (H.). **Preliminary Report regarding Investigations on combating Caterpillar Pests in the Oil Palm Cultivation.**—*Commun. Gen. Expt. Sta. A.V.R.O.S.*, Gen. Ser., no. 48, 31 pp., 3 graphs, 5 pls., 11 refs. Medan, 1931. [Recd. March 1933.]

Thosea asigna, van Eecke, all stages of which are briefly described, has been found to be the principal caterpillar responsible for the defoliation of oil-palms in Sumatra in recent years, damage by other Limacodids and by Psychids being comparatively unimportant. Its eggs

are laid in rows on the lower surface of the leaf blades and probably hatch in 6–8 days. In breeding experiments the larval stage lasted 42–45 days. Pupation occurs in cocoons on the surface or in the upper layer of the soil at the base of the stem, or occasionally in mould-filled cavities between the old leaf stalks. The larvae are parasitised by an Ichneumonid, and the Tachinid, *Chaetexorista javana*, Br. & Berg., which emerge from the cocoons, but parasitism has never been found to exceed 18 per cent. The Pentatomid, *Cantheconidea* (*Canthecona*) *furcellata*, Wolff, and the Pyrrhocorid, *Dindymus rubiginosus*, F., which sometimes occur in considerable numbers, are predacious on the larvae, the young bugs feeding on plants and the older ones on various caterpillars. Large numbers of larvae were killed apparently by a sporozoan disease, though the causal organism was not determined.

In preliminary experiments with insecticides, dusts did not prove promising, owing to their poor adhesion to the oil-palm foliage. Sprays were more satisfactory ; suitable equipment to meet the difficulty of their application in the plantations and the cost involved are discussed at some length. A mixture of 2 per cent. lead arsenate [2 lb. to 10 gals.] and $\frac{1}{2}$–$\frac{3}{4}$ per cent. boiled linseed oil applied in April 1930 remained fairly well on the leaves for $2\frac{1}{2}$ months. Other oils, including a mineral oil and palm oil were less effective as adhesives, and none showed ovicidal qualities when applied to egg masses at low concentrations. Tests were undertaken to determine the minimum lethal dose of lead arsenate, the possibility of substituting Paris green for it and the quantity of lime necessary to prevent injury to the leaves by the latter. Caterpillars were fed on leaves dipped in insecticide, which were renewed every 2 days, and the dead individuals were removed twice a day. Lead arsenate at 2 per cent. gave a somewhat higher and more rapid mortality than at 1 per cent., though at the latter rate it killed 95 per cent. of the larvae in 5 days. An increase in the quantity of lime caused a reduction in the efficiency of 1 per mille Paris green, the mortality obtained decreasing from 88 per cent. after 3 days without lime to 81 per cent. with 5 per mille lime, or 40 per cent. with 15 per mille. The toxicity of 2 per mille Paris green was much less affected, all treatments with varying quantities of lime giving 100 per cent. control before the end of 5 days. Injury to the leaves did not occur with the use of 5 times as much lime as Paris green, but preliminary experiments should be carried out on plantations, as local conditions may influence the results.

CORBETT (G. H.). **Division of Entomology. Annual Report for the Year 1931.**—*Gen. Ser. Dept. Agric. S.S. & F.M.S.*, no. 12, pp. 41–47. Kuala Lumpur, 1933.

Most of the pests observed in Malaya during 1931 have already been noticed from other reports [*R.A.E.*, A, xix, 446, 646 ; xx, 11, 212, 600]. The termite attacking oil palm [*Elaeis guineënsis*] mentioned in the third quarterly report as *Rhinotermes ? malaccensis*, Hlmgr. [xx, 12] is here recorded as *R.* (*Schedorhinotermes*) *longirostris*, Brau., and the species of *Trichogramma*, the breeding of which was discussed under the name *T. minutum*, Riley, as *T. nanum*, Zehnt.

Other pests included : *Setora nitens*, Wlk., *Mahasena corbetti*, Tams, *Artona catoxantha*, Hmps., and *Xylotrupes gideon*, L., on coconut ; *Cephonodes hylas*, L., on coffee ; *Psara submarginalis*, Swinh., *Phytometra signata*, F., *Heliothis assulta*, Gn., and *Phthorimaea* (*Gelechia*)

heliopa, Lw., on tobacco ; *Helopeltis cinchonae*, Mann., and the Lygaeid, *Nysius inconspicuus*, Dist., on tea ; *H. bradyi*, Waterh., and *Stauropus alternus*, Wlk., on gutta-percha ; and the Pyrrhocorid, *Melamphaus faber*, F., attacking the fruits of *Hydnocarpus wightiana*, and *Melissoblaptes fructivora*, Meyr., those of oil palm. Though *Aspidiotus destructor*, Sign., was frequently seen covering the entire oil palm fruit, no perceptible decrease in size was noticed ; it is possible, however, that the feeding of the scale may increase the acidity of the oil.

Miller (N. C. E.). **Insect Pests of Tobacco in Malaya.**—*Malayan Agric. J.*, xxi, no. 2, pp. 66–72, 1 pl. Kuala Lumpur, February 1933.

Brief notes are given on the bionomics of several Lepidopterous pests of tobacco plants in Malaya, *viz.*, *Prodenia litura*, F., *Agrotis ypsilon*, Hufn., *Heliothis* (*Chloridea*) *obsoleta*, F., *H.* (*C.*) *assulta*, Gn., *H.* (*C.*) *flavigera*, Hmps., *Phytometra* (*Plusia*) *chalcites*, Esp., *P.* (*P.*) *signata*, F., *Phthorimaea heliopa*, Lw., *Psara submarginalis*, Swinh., and *Lamprosema diemenalis*, Gn. Natural enemies are rare, but include the Reduviid, *Cosmolestes picticeps*, Stål, which has been observed to attack the larvae of *H. flavigera* and *P. submarginalis* ; a Braconid, *Chelonus* sp., and the Tachinid, *Podomyia setosa*, Dol., which parasitise *Prodenia litura* ; and the Braconid, *Apanteles inquisitor*, Wlkn., a parasite of *L. diemenalis*. Details are given of popular measures that may be employed against these pests and against ants (*Solenopsis* sp.), which carry away the seed from the seed-beds.

Atkinson (D. J.). **Entomological Research.**—*Ann. Rep. Silv. Ent. Burma, 1931–32*, pp. 61–69. Rangoon, 1933.

Further progress in work on forest pests in Burma is reported [*cf.* *R.A.E.*, A, xxi, 182]. Little success was obtained in the breeding of *Xyleutes ceramica*, Wlk. (bee-hole borer) in out-door cages, though in three localities growing trees of teak [*Tectona grandis*] have been successfully stocked with young larvae, of which it is hoped that at least some will complete their development. Observations indicate that the presence of close fairly deep fissures in the bark are necessary for oviposition, and since this is not a normal characteristic of the bark of teak, it is probable that in the field a great majority of the eggs are laid in masses in the comparatively few situations suitable, such as partly occluded old holes, etc., from which the young larvae, which are active on hatching, migrate over the surface of the bark. A considerable mortality of the eggs and young larvae probably occurs. Contrary to previous findings [*loc. cit.*], evidence was obtained of the larval period being completed in one year in some cases. The eggs laid by one female hatched in 18–20 days, confirming earlier records. A relation appears to exist between the incidence of infestation and rain. The quality of the teak is correlated with rainfall, and since the optimum habitat of the tree and of the moth are probably the same, it appears likely that the range of the former is greater than that of the latter. Increased attention to artificial regeneration might, therefore, be advantageous in areas towards the limits of the tree's range.

Since the beginning of breeding work in the insectary with *Hapalia machaeralis*, Wlk. [xxi, 183], 21 successive generations have been reared,

of which 13 occurred in one year, the life-cycle from egg to egg lasting an average period of 28·4 days. In certain generations only females appeared, necessitating the introduction of fresh males, but this was not apparently due to any factor influencing development. The Braconid parasite previously discussed [*loc. cit.*] has been tentatively determined as an undescribed species of *Cremnops*; it was found possible, by holding the host larva in cold storage when mature, to prolong the pupal period of the parasite to a maximum of 31 days, the normal period being 7–8, but not to prevent the emergence of the larva from the host, which occurred at the normal time after the latter had spun its cocoon. Eight generations of *Hyblaea puera*, Cram., were completed between 14th May and 22nd November 1931. It appears improbable that all the annual generations of this species develop on teak, owing to the toughness of the leaves at the end of the season. Several alternative food-plants have been recorded. There seems little doubt, however, that the adults undergo a definite resting phase.

In observations on the Longicorns attacking teak, *Aristobia approximator*, Thoms., was discovered in *Cassia* spp., and further evidence of the polyphagous habits of *Dihammus cervinus*, Hope, was obtained. The maximum length of life of adults of the latter was 4 months 13 days. Teak was also attacked by the larvae of *Batocera* sp., which appears to be rare.

Owing to climatic conditions favourable to its development, *Calopepla leayana*, Latr., was responsible for the almost complete loss of *Gmelina arborea* in a planted area, and its defoliation, dying back and stunting in surrounding natural forests. Hand-picking was undertaken, and large numbers of beetles were collected in March from beneath the bark of dead trees in the natural forest. Adults of its Chalcid parasite [xxi, 184] survived the winter and the hot weather in the insectary, and breeding with their progeny was continued from 22nd June 1931 to September, when the stock of host larvae was apparently exhausted. In order to determine the possibility of rearing a large number of parasites for use against the pupae of the first generation, two pairs of beetles were removed from their resting quarters in March and caged with foliage of *G. arborea* at a temperature and humidity above normal, to discover whether they would begin to feed and oviposit in advance of the normal date. The beetles were extremely lethargic and, though they fed to a slight extent, there was no sign of egg-laying and all died before the end of April.

BODENHEIMER (F. S.). **Ueber die Ausrottung von *Opuntia* ssp. durch *Dactylopius* ssp. auf Grund eigener Beobachtungen auf Ceylon.** [The Eradication of *Opuntia* spp. by *Dactylopius* spp. as observed by the Author in Ceylon.]—*Zbl. Bakt.*, (2) lxxxvi, pp. 155–160, 3 figs., 6 refs. Jena, 1932. [Recd. March 1933.]

Mention is made of some of the insects introduced into Australia for the control of prickly pear (*Opuntia*), and a brief account is given of the successful control in Ceylon of *O. dillenii* by *Dactylopius opuntiae*, Ckll. (*tomentosus* auct.) [*R.A.E.*, A, xviii, 674]. Transport of this Coccid by ants was observed. It is suggested that the cactus is killed by inoculation of some disease or virus, as a very light infestation suffices to cause almost immediate death.

FERRIÈRE (C.). **Description d'un Chalcidien parasite du Longicorne du Caféier en Indo-Chine.**—*Bull. Soc. ent. Fr.*, xxxviii, no. 1, pp. 9–12, 2 figs. Paris, 1933.

Eurytoma xylotrechi, sp. n., is described from Tonkin as a parasite of the larvae of the Cerambycids, *Xylotrechus quadripes*, Chevr. (coffee borer) and *Chlorophorus annularis*, F.

YAGO (M.). **Changes in the Fauna of injurious Insects in the Pear Orchards.** [*In Japanese.*]—*J. Plant Prot.*, xx, pp. 27–32. Tokyo, January 1933.

Changes have occurred in the relative prevalence of insect pests in pear orchards in Shizuoka during the last 10 years. Those that were formerly abundant but are now scarce include *Rhynchites heros*, Roel., *Hoplocampa pyricola*, Rohw., *Acrocercops astaurota*, Meyr., *Eucosma* (*Spilonota*) *ocellana*, Schiff., *Tortrix* (*Cacoecia*) *xylosteana*, L., *Clania* (*Cryptothelea*) *minuscula*, Butl., *Parasa consocia*, Wlk., *Phenacoccus pergandei*, Ckll., *Ceroplastes floridensis*, Comst., *Parlatoria theae*, Ckll., and *Psylla pyrisuga*, Först., the reduction in their numbers being probably due to the recent use of such insecticides as lead arsenate, nicotine sulphate, derris and oil emulsion. *Numonia* (*Eurhodope*) *pirivorella*, Mats., and *Stephanitis nashi*, Esaki et Takeya, have become more numerous recently, and *Cnidocampa flavescens*, Wlk., and *Aulacaspis* (*Diaspis*) *pentagona*, Targ., are not so abundant as in the past.

TAKAHASHI (Y.). **On** *Plagiodera versicolora*, **Laich.** [*In Japanese.*]—*J. Plant Prot.*, xx, pp. 39–43. Tokyo, January 1933.

The Chrysomelid, *Plagiodera versicolora*, Laich., has been observed in the Hyogo Prefecture severely injuring *Salix* in the spring. It has 4 generations a year, and overwinters as an adult, oviposition beginning in late April. The eggs are laid in masses of 130–200 and hatch in 3–8 days. The larval stage lasts 8–19 days, and the pupal stage 2–6, the larvae being particularly abundant in spring and autumn. In summer the adults live 32–68 days.

IWAYAMA (S.). **Some Considerations on Leafhopper Control in the Rice Field after the Shooting of the Flower Stalks.** [*In Japanese.*]—*J. Plant Prot.*, xx, pp. 46–52. Tokyo, January 1933.

Oiling ceases to give satisfactory control of leafhoppers on rice after the plants have grown so dense that the insects do not drop on to the oiled surface, but pyrethrum, with ash as a dust or with soap solution as a spray, is very effective.

TAKAHASHI (S.). **Conclusive Notes on the Heat of stored Grains caused by the Injury of Insects.** [*In Japanese.*]—*Insect World*, xxxvii, no. 1, pp. 10–18. Gifu, January 1933.

Heating of stored grain [*cf. R.A.E.*, A, xix, 338] is not caused by the adults of *Calandra oryzae*, L., but only by the larvae and is highest when the larvae are 12 days old. This is the period at which the respiration and temperature of the larvae are highest.

Maida (S.). **On** *Onychiurus yagii*, **Kinoshita, a Collembolan injurious to Wheat.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 6, pp. 275–281. Tokyo, December 1932.

Onychiurus yagii, Kinoshita, which occurs in Kyushu, prefers wet and cool soils, being found mostly within 6 ins. of the surface of the soil, and very seldom below 9 ins. Sowing germinating wheat seeds reduces the injury, and soy-bean cake, rice-bran and wheat-bran are attractive as baits.

Marumo (I.). **On the Hatching Time of** *Chilo simplex*, **Butl.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, iv, no. 6, pp. 292–299. Tokyo, December 1932.

All the eggs of one mass of *Chilo simplex*, Butl., hatch within 30–70 minutes. Hatching usually occurs in the morning (5–6 a.m.) or, rather less frequently, in the afternoon (2–4 p.m.), but was not observed during the night.

Mitono (T.). **On some Beetles injurious to** *Pinus luchuensis* **in Formosa.** [*In Japanese.*]—*Sylvia*, iii, no. 4, 7 pp., 5 figs. Taihoku, Formosa, November 1932.

Brief notes are given on the Lamiid, *Monochamus tesserula*, White, the Elaterid, *Alaus putridus*, Cand., and the Mordellid, *Glipa formosana*, Pic, which are injurious to *Pinus luchuensis* in Formosa.

Nakayama (S.). **On** *Anadastus fucosus*, **Lewis (Languriidae).** [*In Japanese.*]—*Collect. Addr. Congr. Ass. Agric. Soc. Japan, Keijo, Corea, Oct. 16–17, 1929*, reprint 6 pp., 1 pl. Keijo, Korea. [? 1930.]

Descriptions are given of the larva, pupa and adult of the Languriid, *Anadastus fucosus*, Lewis, which is widely distributed in Korea and attacks Italian millet [*Setaria italica*], 24 per cent. of the stalks being sometimes infested. The beetles are found in summer and live over 2 months. The female lays a single egg in each stalk, and the larva bores downward, pupating in May or June.

Malloch (J. R.). **Notes on Australian Diptera. XXXII.**—*Proc. Linn. Soc. N.S.W.*, lvii, pt. 3–4, pp. 213–217. Sydney, September 1932.

Morgan (W. L.). **Flies and Nematodes associated in Flower Bud Galls of Spotted Gum.**—*Agric. Gaz. N.S.W.*, xliv, pt. 2, pp. 125–127, 3 figs., 1 ref. Sydney, February 1933.

In the first paper a list is given of the species of the Agromyzid genus *Fergusonina*, which are only known from New South Wales, with a key and descriptions of three new species, *F. eucalypti*, *F. biseta* and *F. gurneyi*, all reared from galls on seed capsules of *Eucalyptus maculata*. The Milichiid, *Chaetoleucopis dactylopivora*, gen. et sp. n., is described, also from New South Wales, as probably reared from *Pseudococcus* (*Dactylopius*) *albizziae*, Mask.

Morgan describes the galls from which the Agromyzids, the commonest being *F. eucalypti*, were reared, and which may be the cause of a reduction of seeding noticed in the forests of the south coast districts. Several species of Hymenoptera, some apparently parasitic, were also

reared from the galls, and the larvae of the Curculionid, *Haplonyx albisparsus*, Lea, were found to feed on those of *Fergusonina*. Nematodes were found in the larval cavity of every gall.

FOWLER (R.). **Spraying Experiments for Codlin Moth Control—Blackwood, 1931–32.**—*J. Dept. Agric. S. Aust.*, xxxvi, no. 6, pp. 647–660, 4 figs., 2 refs. Adelaide, 16th January 1933.

An account is given of further experiments [*cf. R.A.E.*, A, xix, 468; xx, 99] with sprays against the codling moth [*Cydia pomonella*, L.] on apples in South Australia carried out between 22nd October 1931 and 16th February 1932. The summer was abnormally dry following a wet winter and the crop of fruit was very heavy; as in previous years when the crop had been heavy, fewer moths than usual were caught in traps, and severe infestation was more easily prevented.

Details of the results of the tests are shown in tables. In each, five applications of spray were made, with the exception of two, in which the calyx spray and the third cover spray respectively were omitted. It was found that a wide variation in infestation may occur under the same treatment. The general results indicated that it is possible in a year of heavy crop of fruit to control the codling moth with five sprays of lead arsenate (4 lb. per 100 gals.) with the addition of a spreader in the last four, but the substitution of an oil and nicotine sulphate spray for the last one increases the effectiveness. The cost is a little higher, but the arsenical residue is decreased to within export tolerance. The omission of one of the cover sprays resulted in only slightly increased infestation. By using combined oil-arsenate sprays good results can be obtained with 3 lb. arsenate and ¾ gal. oil in 100 gals., the oil-nicotine combination being used in the last cover spray. Other oil-arsenate combinations were also used, but the results did not seem to justify the increased costs, and indicate that the application of summer oils is justified only in years of severe infestation, or in districts where *C. pomonella* is particularly difficult to control.

LE PELLEY (R. H.). **Field Spraying with undiluted Paraffin Extracts of Pyrethrum against *Antestia* and *Lygus* on Coffee in Kenya.**—*Bull. Ent. Res.*, xxiv, pt. 1, pp. 1–32, 1 fig., 6 refs. London, March 1933.

The method of applying undiluted kerosene extract of pyrethrum to coffee trees for the control of *Antestia lineaticollis*, Stål, and *Lygus simonyi*, Reut., is described [*R.A.E.*, A, xix, 645; xx, 500; xxi, 34]. Spraying is done from the windward side of the tree, under a cloth cover, which may be removed a few minutes after the operation is completed. In the case of *Antestia*, although most of the bugs fall in the first 5–10 minutes, a number may remain hanging on the branches for up to half-an-hour before falling. As some of the bugs that fall recover, a small quantity of the extract should be sprayed on the ground half-an-hour after spraying. The proportion of *Antestia* brought down by the spray is about 96 per cent., so that a mortality of not much less than 95 per cent. should be possible in practice. In the case of *Lygus* 99 per cent. were brought down on the trees sprayed, and the kill of these was complete.

An experimental field spraying was planned before the September flowering of 1931 to determine whether it was possible in practice to keep down the numbers of *Lygus* alone by periodical applications with

native labour, and whether the trees would flower normally. It was shown that the numbers of *Lygus* could be kept below 2 to a tree [xxi, 34], and the proportion of fruit set on the sprayed trees to that of the control was 3 : 2, indicating an increase of about 8 cwt. to an acre. The technique of the experimental sprayings by which the data given were obtained is described, and the types of pump used for applying the spray are discussed. The tendency to scorch coffee foliage of a number of proprietary kerosenes available for extracting the pyrethrum appeared to vary directly with the proportion of unsaturated hydrocarbons in them.

A biological method has been devised for comparing the toxicities of kerosene extracts of pyrethrum in the laboratory, based, not on mortality data, which proved unsatisfactory owing to the high ultimate mortality produced by comparatively weak extracts, but on the time taken to paralyse *Antestia*. A formula, based on the pyrethrin content of the powder, and the estimate that 1·25 per cent. total pyrethrins is required if 1 lb. pyrethrum is used per gal. of kerosene, is suggested for the preparation of a spray against *Antestia*. Methods of preparing the extract on the plantation for use on a commercial scale are described [xx, 500], and the value of this spray for determining the numbers of insects present on the trees is pointed out.

The effect of the spray on the fauna of coffee plantations is discussed, and the beneficial, injurious and neutral insects killed by it are indicated. Where *Pseudococcus lilacinus*, Ckll., which is not susceptible to the spray, is a major pest and is being controlled by predators, spraying might increase the severity of the infestation, though this has not yet happened in practice. A small experiment showed that the kerosene extract at the rate of 4 gals. to the acre was superior to a water spray at the rate of 1,360 gals. to the acre, the relative costs of application being 12*s*. and £5. With a view to employing a combined fungicide and insecticide, tests were carried out with pyrethrum and Bordeaux mixture in various forms and proportions. A mixture consisting of 1 lb. pyrethrum powder and 40 gals. of a form of Bordeaux commonly used against leaf disease (2 lb. copper sulphate, 12 oz. calcium carbide and 40 gals. water) gave satisfactory results, but cannot be generally recommended for the control of insects on coffee as the cost is greater than that of the extract spray, though it may be of value on other crops.

The economics of spraying against *Lygus* and the method for timing the sprays [xxi, 34] are discussed, and details are given concerning commercial applications against both *Lygus* and *Antestia*, the cost of spraying an acre, including labour and materials, being estimated at about 14*s*. Although designed for less than a year, this method has become the standard control for *Lygus* in Kenya.

PARKIN (E. A.). **The Larvae of some Wood-boring Anobiidae (Coleoptera).**—*Bull. Ent. Res.*, xxiv, pt. 1, pp. 33–68, 15 figs., 29 refs. London, March 1933.

Descriptions are given of the external morphology of the larvae of *Xestobium rufovillosum*, DeG., *Anobium punctatum*, DeG., *Ernobius mollis*, L., *Ptilinus pectinicornis*, L., *Priobium excavatum*, Kug. (*castaneum*, F.), *Ochina ptinoides*, Marsh., *Hedobia imperialis*, L., and *Sitodrepa panicea*, L., with two keys to them, drawn up for use according to whether whole larvae or mounted preparations of parts of

larvae are being examined. Notes are added giving particulars as to the habitat and points of comparison from the descriptions of other workers in the case of each species. The descriptions indicate that *Hedobia*, hitherto generally classified as a Ptinid, is definitely an Anobiid when the structure of the larva is considered.

MENOZZI (C.). **La campagna saccarifera 1932 nei riguardi delle infestioni entomatiche.** [The Sugar-beet Season of 1932 as regards Insect Infestation.]—*Industr. saccarif. ital.*, xxvi, no. 1, reprint 7 pp., 2 figs. Genoa, January 1933.

Much less injury than usual was caused by insects to beet in Italy in 1932, owing to cold, rainy weather early in the year. In Central Italy a crop loss of 1,500–2,000 tons, or only half that in the preceding year, was caused by the larvae of *Conorrhynchus* (*Cleonus*) *mendicus*, Gyll. The measures applied were spraying with barium chloride and allowing turkeys, which have proved of great value, to feed in the fields. *C. mendicus* was observed to fly 30–80 yards, though this is uncommon. The usual measures were applied against *Cassida vittata*, Vill. [*R.A.E.*, A, xx, 252], but only in severe infestations. Two generations matured on beet. The larvae were parasitised by *Tetrastichus bruzzonis*, Masi, this being the first evidence of establishment from distribution in the fields for some years [*cf. loc. cit.*]. In North Italy, *C. nobilis*, L., left its winter quarters very early, feeding on various plants until beet became suitable, whereas its parasites, *Brachymeria vitripennis*, Först., and *T. bruzzonis*, were not in evidence until June. Following the application of control measures, little injury was done by the first generation, and the second was checked by rain. The Halticid, *Chaetocnema tibialis*, Illig., was scarce throughout Italy. The hibernated adults appeared in April and those of the first generation in June, 55–65 per cent. being females. The newly hatched larvae burrowed into the ground to a depth of 2–3 ins. and fed on the beet rootlets. The pupal stage was passed close to the surface and lasted 4–5 days. These data suggest the possibility of control by the use of kainit and by light digging at the time that the larvae come near the surface to pupate.

Pegomyia hyoscyami, Panz., was responsible for a fair amount of injury throughout Italy, but the nicotine sulphate spray again proved effective. Local damage was caused by *Gryllus desertus*, Pall., *Laphygma exigua*, Hb., which first appeared on *Chenopodium album* and was parasitised by the Eulophid, *Euplectrus bicolor*, Swed., *Scotogramma trifolii*, Rott., and *Polia oleracea*, L., which was parasitised by *Brachymeria intermedia*, Nees.

SERVADEI (A.). **Contributo alla conoscenza dei Tentredinidi (Hymenoptera Symphyta) delle Rose. I.** *Ardis sulcata* **Cam.** [A Contribution to the Knowledge of Sawflies of Roses. I. *A. sulcata.*]—*Boll. Lab. Ent. Bologna*, v, pp. 109–132, 13 figs., 2 pls. Bologna, 28th February 1933.

Ardis sulcata, Cam., the egg, larva, and adult of which are described, is a common pest of roses in Italy. The adults emerge towards the end of March, mating about a week later, and oviposit in the unopened leaves, usually at the rate of one egg per leaf. The affected leaves soon wither, but remain on the plant. The larvae, which hatch in about 10

days, feed on the tender leaves and mine in the twigs, from the bases of the leaf-stalks downwards. When mature, they burrow to a depth of 4–5 inches in the ground and form a cocoon in which they hibernate, pupating in the spring.

TOUMANOFF (C.). **Action des champignons entomophytes sur la pyrale du maïs** (*Pyrausta nubilalis*).—*Ann. Parasit. hum. comp.*, xi, no. 2, pp. 129–143, 3 pls. Paris, 1st March 1933.

Details are given of laboratory experiments on the infection of *Pyrausta nubilalis*, Hb., with *Aspergillus flavus*, *Beauveria bassiana*, *B. globulifera* and *Spicaria farinosa*. The following is largely taken from the author's summary : Infection is easily brought about by the simple contact of the spores of entomogenous fungi with the body of the larva, and in the case of *A. flavus*, *B. bassiana* and *S. farinosa*, the three fungi tested, it takes place through the skin. Atmospheric humidity between 46 and 70 per cent. has little influence on infection, but a saturated atmosphere appears to hasten the process slightly. On the other hand, humidity plays an important part in the appearance on the dead bodies of the caterpillars of the mycelium and fruiting bodies and consequently must be favourable to the transmission of infection. Temperatures between 17 and 30°C. [62·6–86°F.] have little effect, but in the case of *B. bassiana* and *A. flavus*, those between 8 and 12°C. [46·4–53·6°F.] are slightly inhibitory. From experiments in which caterpillars were placed for 1 or 6 days in the refrigerator and then kept in an incubator, it is concluded that chilling cannot be considered as a factor diminishing the resistance of the insect to infection by *B. globulifera* or *B. bassiana*. The conidia of the fungi in culture retain their virulence for long periods ; a year-old culture of *A. flavus* was as effective as one 15–30 days old, and the same was true of cultures of *S. farinosa* and *B. bassiana* 6 months old.

Preliminary experiments on the effect of the direct action of the sun's rays on the infectivity of certain fungi indicated that the spores of *B. globulifera* and *B. bassiana* are non-infective after exposures of 2 and 3 hours respectively, but it seems probable that they would be more resistant if they were in suspension in water or on a damp substratum.

RUDOLPH (O.). **Ueber die Erfahrungen mit T-Gas.** [Experiences with T-Gas.]—*Prakt. Desinfekt.*, xxiv, no. 8–9, pp. 199–203. Dresden, 1932. [Recd. March 1933.]

T-gas (a combination of ethylene oxide and carbon dioxide) has proved successful in Germany in house fumigation against insects. In the case of the Ptinid, *Niptus hololeucus*, Fald., 5 oz. to 100 cu. ft. proved completely effective in a cellar, although the walls were rather damp and the gas is absorbed by moisture. As it can penetrate several thicknesses of paper, care is necessary in sealing up a room.

[PLAVIL'SHCHIKOV (N. N.).] **Плавильщиков (Н. Н.). Wood-boring Beetles, Pests of Xylem.** [*In Russian.*]—Demy 8vo, 200 pp., 163 figs., 4 pp. refs. Moscow, Gos. lesn. tekhn. Izd. [State For. Tech. Pub.], 1932. Price 4 *r*. Binding 1 *r*. 50 *kop*. [Recd. April 1933.]

The morphology of the adults, larvae and pupae of Longicorn beetles and their bionomics, geographical distribution, economic importance

and control are described in general, and lists are given of the Cerambycids, Lamiids and Prionids that occur in the Russian Union, showing their distribution and the trees they attack, and of the trees, showing the beetles that infest them. Keys are included to the families and genera, as well as to the adults and larvae of many of the species and the types of injury caused by the latter. A section of 73 pages deals with the bionomics and control of the most important species. Instructions are also given for the collection and breeding of Longicorns, and an index to their scientific and Russian names is appended.

[PLOTNIKOV (V. I.).] **Плотников (В. И.).** Ed. **The chief Pests and Diseases of agricultural Plants in Central Asia and their Control under the Conditions of socialistic Farming.** [*In Russian.*]—*Ser. Uchebn. s.-kh. Tekhnik.* [Ser. Manuals for Agric. Schools], no. 1, 224 pp., 124 figs. Tashkent, 1932. Price 1 *r.* 40 *kop.* [Recd. April 1933.]

In this popular handbook for agricultural schools, about 45 pages deal with the anatomy, biology, natural enemies, diseases, and control of insect pests in general, and 82 pages with the principal species occurring in Central Asia.

GREEN (E. E.). **Notes on some Coccidae from Surinam, Dutch Guiana, with Descriptions of New Species.**—*Stylops*, ii, pt. 3, pp. 49–58, 12 figs. London, March 1933.

The species described include *Geococcus coffeae*, sp. n., *Rhizoecus moruliferus*, sp. n., *R. coffeae*, Laing (male), and *Pseudorhizoecus proximus*, gen. et sp. n., all taken from the roots of a single coffee tree (*Coffea liberica*). The following are said to go over to coffee roots: *Rhizoecus caladii*, sp. n., described from *Caladium bicolor*; *Pseudorhizoecus migrans*, sp. n., from *Paspalum* and other grasses; *Pseudococcus podagrosus*, sp. n., from *Montichardia* sp.; *P. radicis*, sp. n., from Cyperaceae; and *Phenacoccus surinamensis*, sp. n., from Labiatae. *Cryptostigma bunzlii*, sp. n., was found on large roots of *Erythrina* exclusively, and is said to cause great damage in some years. The ovisac of *Orthesiopa reynei*, Laing [*R.A.E.*, A, xiii, 350] is also described.

MARSHALL (Sir G. A. K.). **New Neotropical Curculionidae (Col.).**—*Stylops*, ii, pt. 3, pp. 59–69, 3 figs. London, March 1933.

Among the new species described are *Lachnopus buchanani* from coffee (*Coffea arabica*) in Cuba, *Hypsonotus frontalis* and *Arniticus bondari* from cacao in Bahia, Brazil, and *Stenotylus* (gen. n.) *mativorus* from stumps of *Ilex paraguayensis* in Argentina.

MCPHAIL (M.) & BLISS (C. I.). **Observations on the Mexican Fruit Fly and some related Species in Cuernavaca, Mexico, in 1928 and 1929.**—*Circ. U.S. Dept. Agric.*, no. 255, 24 pp., 6 figs., 1 ref. Washington, D.C., January 1933.

In a region south of Mexico City, at a height of 5,000 ft., *Anastrepha ludens*, Lw. (Mexican fruit-fly) was found to breed abundantly on mango and less frequently on sweet lime, orange, peach, pomegranate and guava. Off-season mangoes made an alternate host unnecessary. Guavas were infested chiefly by *A. striata*, Schin. (Central American fruit-fly), and *Spondias mombin* by *A. fraterculus*, Wied. (West Indian fruit-fly). All species, particularly *A. striata*, were aided by the

maturing of their favourite host fruits during the rainy season, mango in May-June, guava in August-September and *S. mombin* in September–October. Local temperature was more uniform than in any of the *Citrus* regions of the United States; rainfall approximated most nearly to that of Florida.

The adults of *A. ludens* preferred ripe fruit (mango or guava) to green for feeding and green to ripe for ovipositing. In feeding they showed less definite preference for one host species. The eggs did not appear to hatch more slowly on green fruit [*cf. R.A.E.*, A, xvi, 259]. The greatest number hatched in 7 days and at a mean temperature of 73·4°F. Larvae reared in the laboratory developed in 18·5–35 days, whereas in the field the maximum period appeared to be longer. Over 90 per cent. of larvae emerged from the fruit in the morning before 9 a.m., and emergence was stimulated by a cool night, by rainfall, or by placing the fruit on wet sand. They formed their puparia in moist sand, avoiding dry. The prepupal and pupal stage totalled 32 days at 64·4°F. and 21 at 73·4°F., females averaging a few hours longer than males. Larval food did not affect length of development. Exposure to drying during the first 5 days after the formation of the puparia greatly increased mortality. Of the adults 96 per cent. emerged between 6 and 10 a.m.; emergence was greatly reduced by burying infested fruits [*cf.* xviii, 377]. First mating occurred 11–25 days after emergence. Oviposition normally began a few days later and might continue more than a month; females occasionally oviposited before mating. Between January and April, female fertility increased with the mean temperature. Length of adult life varied greatly; in a few instances it was prolonged to 6 months. Parasitism was confined largely to the Braconid, *Diachasma* (*Opius*) *crawfordi*, Vier., increasing from 1·4 per cent. in April to 27·8 in June in dropped fruits. Parasitised larvae formed apparently normal puparia, from which adult parasites emerged about 1½ days later than the normal emergence of *A. ludens*. Three other parasites reared from fruit-fly pupae in small numbers were *Galesus* sp., *Eucoila* sp., and *Villa* (*Anthrax*) *scylla*, O.S.

Papers noticed by Title only.

Eggers (H.). **Zur paläarktischen Borkenkäferfauna** [On the Palaearctic Bark Beetle Fauna, including many new species].—*Ent. Bl.*, xxix, no. 1, pp. 1–9. Berlin, 31st March 1933.

Carter (W.). **The Pineapple Mealy Bug,** *Pseudococcus brevipes*, **and Wilt of Pineapples.**—*Phytopathology*, xxiii, no. 3, pp. 207–242, 12 figs., 19 refs. **The Spotting of Pineapple Leaves caused by** *Pseudococcus brevipes*, **the Pineapple Mealy Bug.**—*T.c.*, pp. 243–259, 5 figs. Lancaster, Pa., March 1933. [*Cf. R.A.E.*, A, xxi, 64.]

Kuwana (I.). **Description of two new Coccidae** [*Eriococcus tokaedae*, sp. n., and *Lepidosaphes ezokihadae*, sp. n.] **from Japan.** [*In Japanese & English.*]—*Kontyû*, vi, no. 4, pp. 143–148, 1 pl. Tokyo, November 1932.

Shimizu (M.). **Oviposition of** *Epiurus* [*Pimpla*] *persimilis*, **Ashm., a Parasite of** *Margaronia pyloalis* **Wlk.** [*In Japanese.*]—*Kontyû*, vi, no. 4, p. 169, 2 figs. Tokyo, November 1932.

Yago (M.) & Tsutsumisaka (K.). **Number of Eggs of** *Lecanium cerasorum*, **Ckll.** [*In Japanese.*]—*Kontyû*, vi, no. 4, pp. 181–182. Tokyo, November 1932.

BALACHOWSKY (A.). **Contribution à l'étude des Coccides de France. (15e note). Un** *Eriococcus* [*E. glanduliferus*, sp. n.] **nouveau du Departement du Var.**—*Bull. Soc. ent. Fr.*, xxxviii, no. 3, pp. 36–38, 1 fig. Paris, 1933.

LINDINGER (L.). **Beiträge zur Kenntnis der Schildläuse.** [Contributions to the Knowledge of Coccids (including changes in nomenclature).]—*Ent. Rdsch.*, 1, no. 3, pp. 31–32, 46. Stuttgart, February 1933. [*Cf. R.A.E.*, A, xxi, 142, 199.]

LINDINGER (L.). **Beiträge zur Kenntnis der Schildläuse (Coccidae).** *Tachardia* **oder** *Laccifer*? [Contributions to the Knowledge of Coccids. *Tachardia* or *Laccifer*?]—*Ent. Z.*, xlvi, no. 21, p. 228. Frankfurt a.M., 22nd February 1933.

VAYSSIÈRE (P.). **Une Cochenille halophile** [*Ripersia salsolae*, sp. n.] **en Tunisie.**—*Bull. Soc. ent. Fr.*, xxxviii, no. 4, pp. 57–59, 2 figs. Paris, 1933.

BALACHOWSKY (A.). **Contribution à l'étude des Coccides des Colonies françaises. (Ire Note.) Sur une Diaspine nouvelle** [*Aspidiotus dallonii*, sp. n.] **du Tibesti.**—*Bull. Soc. Hist. nat. Afr. N.*, xxiii, no. 8, pp. 228–231, 1 pl., 8 refs. Algiers, November 1932. [Recd. March 1933.]

SHULL (A. F.). **The Time of embryonic Segregation in Aphids as determined from intermediate Types.**—*Proc. Nat. Acad. Sci.*, xix, no. 1, pp. 164–175, 6 refs. Washington, D.C., January 1933.

DE FLUITER (H. J.). **De Bloedluis** *Eriosoma lanigerum* **(Hausm.) in Nederland.**—*Tijdschr. Plantenziekt.*, xxxvii, nos. 11–12, pp. 201–329, 13 pls., 4 graphs, 97 refs. Wageningen, 1931. [Recd. April 1933.] [See *R.A.E.*, A, xx, 2.]

HOTTES (F. C.). **Descriptions of Aphidae from Western Colorado** [including 11 new species].—*Proc. Biol. Soc. Washington*, xlvi, no. 1, pp. 1–24. Washington, D.C., 20th February 1933.

BRUCK (C. R.). **Two new Species of** *Phloeosinus* **Chapuis (Scolytidae-Coleoptera)** [from California].—*Canad. Ent.*, lxv, no. 3, pp. 54–56. Orillia, Ont., March 1933.

ROARK (R. C.). **Review of United States Patents relating to Pest Control** [issued January-March 1932].—v, nos. 1–3; 11, 12, 12 pp. multigraph. Washington, D.C., U.S. Dept. Agric., Bur. Chem. & Soils, 1932.

JONES (H. A.). **Assay of Plant Material for its Rotenone Content. An Extraction Method.**—*Industr. Engng. Chem.*, Anal. edn., v, p. 23, 14 refs. Easton, Pa., 15th January 1933. [A more detailed account of a method using carbon tetrachloride (*R.A.E.*, A, xx, 283).]

JONES (H. A.) & SMITH (C. M.). **A Color Test for Rotenone.**—*T.c.*, p. 75, 1 ref. Easton, Pa., 15th January 1933.

CLARK (E. P.) & CLABORN (H. V.). **Tephrosin. II. Isotephrosin.**—*J. Amer. Chem. Soc.*, liv, pp. 4454–4456, 1 ref. Easton, Pa., 5th November 1932.

HALLER (H. L.). **Rotenone. XXIV. Synthesis of Tetrahydrotubanol.**—*T.c.*, p. 4755. Easton, Pa., 13th December 1932.

CLARK (E. P.) & KEENAN (G. L.). **Note on the Occurrence of Dehydrodeguelin and Dehydrotoxicarol in some Samples of Derris Root.**—*Op. cit.*, lv, pp. 422–423, 5 refs. Easton, Pa., 11th January 1933.

CLARK (E. P.). **Tephrosin. III. Some acidic Derivatives of Tephrosin.**—*T.c.*, pp. 759–762, 3 refs. Easton, Pa., 9th February 1933.

GERSDORFF (W. A.). **A Study of the Toxicity of Rotenone Hydrochloride, Acetylrotenone and Rotenolone using the Goldfish as the Test Animal.**—*T.c.*, pp. 1147–1152, 8 refs. Easton, Pa., 7th March 1933.

ROARK (R. C.). **A Second Index of patented Moth-proofing Materials.**—109 pp. mimeographed. [Washington D.C.] U.S. Dept. Agric., Bur. Chem. & Soils, February 1933. [*Cf. R.A.E.*, A, xix, 456.]

INKMANN (F.). **Beiträge zur Entwicklungsgeschichte des Kornkäfers (*Calandra granaria* L.). Die Anfangsstadien der Embryogenese.** [Studies on the Course of Development of *C. granaria*. The initial Stages of the Embryogeny.]—*Zool. Jahrb.*, Abt. Anat., lvi, no. 3–4, pp. 521–558, 6 pls., 4 pp. refs. Jena, 22nd February 1933.

DINGLER (M.). **Zur Variation der Flügeldeckenzeichnung bei *Crioceris duodecimpunctata* L. und *Crioceris asparagi* L.** [Variation in the Marking of the Elytra of *C. duodecimpunctata* and *C. asparagi*.]—*Koleopt. Rdsch.*, xix, no. 1–2, pp. 57–66, 6 figs., 8 refs. Vienna, 31st March 1933.

KÜHN (A.) & HENKE (K.). **Genetische und Entwicklungsphysiologische Untersuchungen an der Mehlmotte *Ephestia kühniella* Zeller. viii–xii.** [Investigations on Genetics and Physiology of Development in *E. kühniella*.]—*Abh. Ges. Wis. Göttingen*, (N.F.) xv, no. 2, pp. 123–219, 3 pls., 41 figs., 16 refs. Berlin 1932. [*Cf. R.A.E.*, A, xviii, 383.]

LIGHT (S. F.). **Termites of the Marquesas Islands.**—*Bull. Bishop Mus.*, xcviii, pp. 73–86, 3 pls., 5 figs., 5 refs. Honolulu, 1932.

LIGHT (S. F.). *Kalotermes* (*Glyptotermes*) *juddi*: **a new Species of Termite from the Marquesas Islands.**—*T.c.*, pp. 169–170, 1 ref.

LIGHT (S. F.). **Key to the Marquesan Species of Termites, with Records of Host Plants and Distribution.**—*T.c.*, pp. 171–176, 2 refs.

BETREM (J. G.). **Eine neue aus Manga-Früchten gezüchtete Pimpline (Fam. Ichneumonidae).** [A new Pimpline, *Flavopimpla mangae*, gen. et sp. n., bred from Mango Fruits (possibly from the larva of *Cryptorrhynchus gravis*, F.) in Java.]—*Treubia*, xiv, no. 1, pp. 21–28, 1 pl., 16 refs. Buitenzorg, December 1932. [Recd. March 1933.]

ROBERTS (F. H. S.). **The Bacon Fly or Ham Skipper** [*Piophila casei*, L.]—*Ent. Leafl. Dept. Agric. Queensland*, no. 17, 2 pp., 1 pl. Brisbane, April 1931. [Recd. April 1933.] [See *R.A.E.*, A, xix, 507.]

SCHULTZ (E. F.). **La *Icerya purchasi* o Cochinilla algodonosa y su represión por medio de la *Vedalia cardinalis*.** [*I. purchasi* and its Control by *Rodolia cardinalis*.]—*Circ. Estac. exp. agríc. Tucumán*, no. 32, 6 pp., 2 figs. Tucumán, 1933.

Notes are given on the infestation of oranges in the province of Tucumán, Argentina, by *Icerya purchasi*, Mask., and on the very successful employment against it of the Coccinellid, *Rodolia* (*Vedalia*) *cardinalis*, Muls., imported in 1932 [*R.A.E.*, A, xxi, 50].

BODENHEIMER (F. S.). **Der Massenwechsel in der Tierwelt. Grundriss einer allgemeinen tierischen Bevölkerungslehre.** [Fluctuation in Abundance in the Animal Kingdom. An Outline of a general Theory of Animal Population.]—*Arch. zool. ital.*, xvi, pp. 98–111. Padua, 1931. [Recd. March 1933.]

The author discusses the different factors regulating the abundance of individual species of animals and the various views as to their relative importance. In the case of insects, he considers climate to exercise a decisive influence [*R.A.E.*, A, xvii, 489].

VAN HALL (C. J. J.). **Cacao.**—2nd. edn., Demy 8vo, xviii+514 pp., 176 figs., 1 fldg. table, many refs. London, Macmillan & Co., Ltd., 1932. Price 28*s*. net.

Since the publication of the first edition of this practical handbook in 1914 [*R.A.E.*, A, iii, 660], much information has accumulated on cacao and its cultivation, necessitating the revision and extensive alteration of the majority of the chapters. The ninth chapter (pp. 226–303) contains a general survey of the diseases and enemies of cacao, the methods employed for their control being briefly outlined; the insect pests, which are very numerous, and of which many further species are recorded, are discussed at length, and additional sections are included on termites and pests of stored cacao.

DELONG (D. M.). **Three Species of *Empoasca* Leafhoppers known to affect Economic Plants in Haiti (including the Description of two new Species.)**—*J. Dept. Agric. Puerto Rico*, xvi, no. 2, pp. 113–115, 1 pl. Rio Piedras, P.R., 1932. [Recd. April 1933.]

Descriptions are given of *Empoasca fabalis*, DeLong [*R.A.E.*, A, xviii, 494], *E. gossypii*, sp. n., from cotton and *E. canavalia*, sp. n., from *Canavalia ensiformis*, in Haiti.

FELT (E. P.). **A new Citrus Cambium Miner from Puerto Rico**—*J. Dept. Agric. Puerto Rico*, xvi, no. 2, pp. 117–118. Rio Piedras, P.R., 1932. [Recd. April 1933.]

Descriptions are given of the larvae and adults of both sexes of the Cecidomyiid, *Asynapta citrinae*, sp. n., which was reared from larvae boring in the cambium of grapefruit twigs in Porto Rico, the pupal stage being passed in cocoons in the soil and lasting from 11th to 15th July in 1931.

Hart (P. C.). **Entomologisch onderzoek.** [Entomological Investigation.]—*Versl. Cultuurafd. Proefst. Java-Suikerind.* **1931**, pp. 48–64. Surabaya, 1932. [Recd. March 1933.]

Most of the work on sugar-cane pests in Java in 1931 concerned the tip borer, *Scirpophaga intacta*, Sn. [*R.A.E.*, A, xix, 568 ; xx, 433]. The percentage of parasitism of its eggs by the Scelionid, *Phanurus beneficiens*, Zehnt., was studied by clearing the egg-masses in a solution of 2·2 lb. choral hydrate in 1·6 pt. benzene. It would seem that the percentage falls when egg-masses are scarce, as in plantations where control measures are employed. A local outbreak of *Chionaspis tegalensis*, Zehnt., was attributed to the planting of infested setts. In an examination of sugar-cane of the variety POJ 2961 attacked by *Diatraea venosata*, Wlk. (*striatalis*, Sn.), most of the living larvae were found in the upper portions of the canes.

van der Meer Mohr (J. C.). **Overzicht van de plagen van de tabak in Deli.** [A Survey of the Pests of Tobacco in Deli.]—*Meded. Deli Proefst.*, (2) no. 81, 94 pp., 9 figs., 43 pls. Medan, 1932. [Recd. March 1933.]

This catalogue of the animal pests, chiefly insects, of tobacco in Deli, Sumatra, includes notes on the control measures practised against each species, and in most cases a brief description of its external characters and biology. The numerous plates, the legends of which are in Dutch and English, are intended to facilitate recognition of the pests concerned by comparison with specimens supplied to each plantation.

van der Meer Mohr (J. C.). **Plagen der tabak.** [Pests of Tobacco in Deli in 1932.]—*Meded. Deli Proefst.*, (2) no. 83, pp. 22–33, 1 map. Medan, 1933.

In 1932 infestation of tobacco in Deli, Sumatra, by *Phytometra signata*, F., *Heliothis assulta*, Gn., and *Prodenia litura*, F., was more general than in 1931. Slight injury was caused by some of the other pests recorded in the previous report [*R.A.E.*, A, xx, 272] and by *Engytatus tenuis*, Reut., *Gryllus mitratus*, Licht., and the cockroach, *Leucophaea* (*Pycnoscelis*) *surinamensis*, L. The Tenebrionid, *Dasus* (*Opatrum*) *acutangulus*, Fairm., occurred in two localities only, but proved very harmful there. When the seedlings were planted out, the lowest leaves were pressed against the stems in the hope that the beetles would bore first into the mid-ribs of these leaves, so that injury to the stems would be reduced. The ant, *Solenopsis geminata*, F., caused great damage in the seed-beds in some plantations, such outbreaks being unusual.

Sison (P.). **The Slug Caterpillar on Abacá (*Thosea sinensis* Wlk.), its Life History and Habits as observed in Davao, and Suggestions for Control.**—*Philipp. J. Agric.*, iii, no. 3, pp. 163–188, 6 pls., 3 refs. Manila, 1932. [Recd. April 1933.]

Thosea sinensis, Wlk., all stages of which are described, is a destructive pest of Manila hemp (*Musa textilis*) and coconut and is widely distributed in the Philippines. Other food-plants include wild palms mango, maize, sugar-cane and grasses. Although the Manguindanao variety of *M. textilis* is less susceptible to attack than the other varieties,

its cultivation cannot be recommended on account of its lack of productiveness. Both *M. textilis* and coconut are defoliated, but eventually recover, the former becoming normal again after about 4 months. The larvae first feed on the lower, or more rarely the upper surface of the leaves, but from the third instar onwards they consume the whole tissue.

Observations showed that the life-cycle from egg to adult varies from 78 to 102 days, so that 3–4 generations are possible in a year. The adult moths, which are only active at night, do not fly far from the places where they emerge. The eggs are laid on the leaves in groups of 2–7, a day after mating. They hatch in 5–8 days, and the larval stage lasts 47–61. The larvae usually feed during the night and cooler parts of the day, but those present in the interior of plantations feed more or less continuously. When fully grown, the larvae crawl down the stems to spin cocoons in which they pupate at the base of the tree. The moths emerge after 26–33 days; adult life in the laboratory lasted 2–14 days with an average of 5. The sexes were equally represented. Females laid 144–508 eggs, with an average of 315, the percentage hatching being 95·45 under field conditions and 100 in the laboratory.

The only parasites observed were two Braconids and a Tachinid that attack the larvae. The latter are also destroyed by the Pentatomid, *Cantheconidea* (*Canthecona*) *furcellata*, Wolff, crows and monkeys, and the pupae by fowls.

In insecticide tests, a contact spray consisting of 1 part soap to 20–60 parts water was effective against the larvae and did not scorch the foliage of *M. textilis*. The addition of calcium arsenate did not render the spray effective as a stomach poison, and the mixture scorched the leaves. Tests with light-traps showed that the moths are only attracted to lights with a power of 100 candles and over, and it has not yet been decided whether such traps may not do harm by attracting more parasites than moths. Control measures recommended include the collection of larvae and cocoons, spraying with soap solution and encouraging natural enemies. The smaller of the two Braconid parasites may be fostered by planting as a cover crop *Calopogonium mucunoides*, at the flowers of which it appears to feed. Fowls should be allowed into the fields when the larvae are beginning to pupate, and other birds should be protected. Alternative food-plants should be destroyed.

FULLAWAY (D. T.). **Division of Entomology.**—*Hawaiian For. Agric.*, xxx, no. 1, pp. 55–59. Honolulu, 1933.

A summary is given of work done in the propagation and distribution of beneficial insects in Hawaii in 1931–32 [*R.A.E.*, A, xx, 22, 572, 721]. Insect enemies of the pineapple mealybug [*Pseudococcus brevipes*, Ckll.] imported from Panama included the Encyrtid, *Zaplatycerus fullawayi*, Timb., which was released in Hawaii, but failed to breed in confinement there though it had done so in Panama, and the Drosophilid, *Pseudiastata nebulosa*, Coq., the larvae of which are predacious on the mealybug. A Platygasterid, *Allotropa* sp., parasitising another mealybug on *Ficus nitida*, was also shipped, since it was found in connection with *P. brevipes* in Mexico, but apparently did not succeed in Hawaii. A Cecidomyiid found in connection with *Ferrisiana* (*P.*) *virgata*, Ckll., on *Ficus nitida* was shipped repeatedly. The Encyrtid,

Blepyrus tachigaliae, Brues, which was originally described from the pineapple mealybug [x, 349], parasitises a similar mealybug on *Cecropia* in Panama. It could not, however, be reared on examples of *P. brevipes* brought from Hawaii. Over 200 tree-frogs (*Dendrobates tinctorius*) were also imported from Panama.

The occurrence in Hawaii of the gladiolus thrips (*Taeniothrips gladioli*, Moult. & Stnw.), and the apparent eradication of *Megamelus proserpina*, Kirk., on taro [*Colocasia*] have already been noticed [xxi, 229]. The species of *Empoasca* causing tip-burn of melons [xx, 225] was effectively dealt with by Bordeaux-nicotine sprays designed to act as both an insecticide and a repellent. A campaign against *Coptotermes*, chiefly by means of arsenical poisons, has had some success.

JARVIS (E.). **Cane Pest Combat and Control. The Greyback Cane Beetle.**—*Queensland Agric. J.*, xxxix, pt. 2, pp. 60–63, 3 figs. Brisbane, February 1933.

Detailed instructions are given on the use of a hand-injector for fumigating the soil with carbon bisulphide against the greyback cockchafer [*Lepidoderma albohirtum*, Waterh.] on sugar-cane roots in Queensland [*R.A.E.*, A, xvi, 378, 379; xix, 256]. After wet weather, first instar larvae often move upwards to within 4 inches of the surface of the soil to feed on young roots [xv, 349]; during the next 2–3 weeks, they sometimes penetrate to a depth of 6–7 inches. In the second instar, which predominates in February, they feed on the larger roots and begin to attract notice. In the third they feed more on the large cord-like roots that anchor the stools. An area with 3–4 larvae per stool should be fumigated. Instructions are given for determining the degree of infestation, with a table showing the best dates for beginning fumigation (about 9–10 weeks after first emergence of the adults). Injections (of about $\frac{1}{6}$ oz. carbon bisulphide each) should be made about 1 foot apart on both sides of the cane-row, 3 inches from the stools and 4–4½ inches deep. It has been found advisable to give 5–6 injections to certain large stools. Paradichlorobenzene may be dissolved in the carbon bisulphide at the rate of 66 lb. to 5 gals.

VEITCH (R.). **The Grape Phylloxera.**—*Queensland Agric. J.*, xxxix, pt. 2, pp. 79–83, 7 figs. Brisbane, February 1933.

Phylloxera vitifoliae, Fitch, was found on vine-roots near Brisbane in November 1932, the first record in Queensland since 1910. The nature of the infestation is described, and notes are given on measures of control practised in other countries. The leaf-gall form was not observed and is extremely rare in other parts of Australia.

DODD (A. P.). **The Present Position and future Prospects in Relation to the biological Control of Prickly Pear.**—*J. Coun. Sci. Ind. Res. Aust.*, vi, no. 1, pp. 8–13. Melbourne, February 1933.

The situation at the time of the last report on the investigations of the biological control of prickly-pear [*Opuntia* spp.] in Australia carried out by the Commonwealth Prickly Pear Board is reviewed [*R.A.E.*, A, xviii, 287], and an account is given of the progress made since May 1929 [*cf.* xxi, 91, etc.]. The distribution of *Cactoblastis* [*cactorum*, Berg] was practically completed at the end of 1930, when

3,000,000,000 eggs had been released. By the end of 1931 the moth had become established on practically every acre of the prickly-pear infestation in Queensland and New South Wales, and widespread collapse of the primary pear followed its activities in every district except the southern infested area of the latter State. A comprehensive scheme for reclaiming the land released from prickly-pear has been put forward by the Queensland Government.

As the effectiveness of *C. cactorum* has increased, that of the other pear insects has diminished. Dense concentrations of the Coreid, *Chelinidea tabulata*, Burm., have decreased considerably during the past two years, *Tetranychus opuntiae*, Banks, is no longer an effective controlling agency, and the sphere of usefulness of cochineal [*Dactylopius*] has been restricted to the sporadic destruction of new growth.

The problem of re-growth is discussed [xx, 157 ; xxi, 91]. Although *C. cactorum* destroyed the second wave of *Opuntia* readily, a special endeavour is being made to establish other insects for its more rapid control. Supplies of *Dactylopius* have been secured from several places in America and are being reared with a view to their distribution in the near future. An effort is also being made to import from North America *Mimorista* [*flavidissimilis*, Grote], the larvae of which feed on the young growth solely. Natural parasites attack *C. cactorum*, but the rate of mortality they cause is not serious and does not appear to be increasing. The habits and controlling effect of these parasites are, however, undergoing investigation. The present average percentage of parasitism is 15 in Central Queensland and north-western New South Wales, 5–10 in southern and south-western Queensland, and 20 in the Hunter River district of New South Wales, where the Pyralid has failed to become generally established, owing to a combination of climatic factors and soil conditions.

C. cactorum will destroy the upper growth of the tiger pear (*O. aurantiaca*), which occurs in many places in Queensland and New South Wales and is increasing rapidly, but not the underground bulb. A special investigation has therefore been carried on in Argentina of the insect enemies of *O. aurantiaca* and nearly related species, as a result of which a strain of *Dactylopius* that attacks it has already been sent to Australia. Similarly *C. cactorum* will destroy only the young plants of *O. tomentosa*, which occurs over extensive areas in Central Queensland. However, while *O. stricta* and *O. inermis* are present in the same district to provide suitable food for the larvae, the moths maturing from them will oviposit on the young plants of *O. tomentosa*, and the larger plants will gradually die of old age. If *O. stricta* and *O. inermis* were eradicated and the control of *O. tomentosa* ceased, further steps would have to be taken to introduce specialised insect enemies of this plant.

SMIT (B.). **The Plague of Ants.**—*Fmg. S. Afr.*, reprint no. 52, 1 p. Pretoria, July 1932. [Recd. April 1933.]

In South Africa, *Anoplolepis* (*Plagiolepis*) *custodiens*, Fr. Smith, fosters various Aphids and Coccids and is of particular importance in preventing the control of the citrus mealybug [*Pseudococcus citri*, Risso] by *Cryptolaemus* [*montrouzieri*, Muls.] [*cf. R.A.E.*, A, xx, 307]. In experiments, the ants were not long deterred by repellent bands on the *Citrus* trees, but adhesive bands were more effective, provided that they were protected against dust by an inverted funnel of asphalt roofing material. Even better results were obtained by putting the

adhesive on the inner surface of the funnel and plugging any space between it and the bark with cotton-wool. The most effective of several poison baits tested was prepared by boiling for ½ hour a solution of 12 lb. sugar, ¼ oz. crystallised tartaric acid and ¼ oz. sodium benzoate in 10 pints of water, then adding a solution of ¾ oz. sodium arsenite in 1 pint of water, and finally stirring in 2 lb. strained honey. This did not kill the ants on the spot, but was taken by them to the nest and fed to their young [*cf.* viii, 285]. Poisoning should be begun early in the spring, as otherwise the ants may be attracted from the bait by the honeydew of the mealybugs. The best results were obtained by putting half a teacupful in a ¼ lb. paper bag, dipped in paraffin wax and pierced with holes at least ¼ inch in diameter. In a week, one bag fastened to a tree practically cleared it of ants for the season, though untreated trees 20 yards away continued to be swarming with them. Their absence encouraged not only Coccinellids but apparently also Chalcids, Chrysopid larvae and other natural enemies of the mealybug.

Necessary Work on Insect Pests.—*Bull. Dept. Agric. Gold Coast,* no. 24, pp. 13–18. Accra, 1932. [Recd. April 1933.]

Notes are given on the problems presented in the Gold Coast by the more important insect pests and the lines on which future investigations should be undertaken. The damage caused to *Citrus* fruit by the adults of *Othreis* sp., *O. fullonica,* L., *Achaea* sp. and *A. lienardi,* Boisd., which puncture the rind of ripe grapefruits, oranges and tangerines, causing them to rot and fall, constitutes a limiting factor to the export of the crop grown during April–June. The larvae feed on several kinds of bush plants, and the moths migrate some distance in search of fruits, which are attacked for about 2–3 weeks. They do not apparently injure sour oranges or limes, but mangos, guavas and other soft fruits are known to be attacked. Exported cacao is damaged by *Ephestia elutella,* Hb., and *Araecerus fasciculatus,* DeG. [*R.A.E.*, A, xviii, 174]. Infestation by the latter, which is more common and apparently prefers moist beans, originates on the drying trays in farms. Heavy losses are caused to the cola industry by the weevil, *Balanogastris colae,* Desbr., which oviposits on the beans, into which the larvae bore. The chief source of infestation appears to be broken beans, as the weevils cannot pierce the shell of the fruit, and control could probably be effected if the fruits were not opened in the neighbourhood of bearing trees.

Locusta migratoria migratorioides, Rch. & Frm., invaded the Colony each year from 1929 to 1932, the damage being confined to graminaceous crops [*cf.* xix, 710; xx, 208]. Oviposition took place where gravid females occurred among the swarms, hoppers appearing locally, but it is considered doubtful whether situations suitable for permanent breeding areas occur in the Gold Coast. A main factor in the requirements for a permanent breeding ground is probably the rise and fall of the water-level in large perennial swamps and the effect on the grass vegetation in the immediate vicinity [*cf.* xxi, 32], together with suitable conditions of the soil for oviposition. Many of the locusts in some bands have recently been destroyed by the larvae of a Tachinid, which burrow into the thoracic muscles of the hoppers and newly winged adults. Natural enemies, however, are of doubtful importance in the control of locusts.

Insects of the Season 1931.—*62nd Ann. Rep. Ent. Soc. Ontario* **1931**, pp. 7–34. Toronto, 1932. [Recd. March 1933.]

Notes are given by various authors on a large number of insect pests observed in the different Provinces of Canada during 1931.

DUSTAN (A. G.) & MATTHEWMAN (W. G.). **Some Notes on the Cyclamen Mite** (*Tarsonemus pallidus* **Banks), a Pest of Strawberry Plants.**—*62nd Ann. Rep. Ent. Soc. Ontario* **1931**, pp. 34–37. Toronto, 1932. [Recd. March 1933.]

A study of the biology and control of *Tarsonemus pallidus*, Banks (cyclamen mite) was begun at the end of 1928 at Ottawa, where it had been attacking strawberry plants for a few years previously. It has also been observed in widely separated districts in the United States and Canada [*R.A.E.*, A, xix, 16]. In cases of slight injury the leaves take on a copper-bronze colour, and in severe cases the petioles are shortened, the margins at the base of the leaflets rolled under and the whole plant appears stunted. Few runners are made and the fruit yield is poor.

The adults inhabit the crown of the plants in spring and autumn and the folds of the leaflets in summer, the immature forms and eggs being found within the unfolded leaflets. Apparently only the adult females hibernate, within the leaf sheaths at the bases of the petioles. They begin to oviposit from the middle of April. There is only one larval instar, which is followed by a short quiescent stage, at the end of which the larva moults and becomes an adult. The peak of infestation is from the middle of June to the end of July, when as many as 300 adults may occur on a single plant. Oviposition decreases in August and ends in October. Dissemination chiefly takes place along the runners to the daughter plants, but the mites are distributed more rapidly by wind. Investigation has shown that they cannot move through the soil, since they die in 7–8 days when placed in it ; and they can only survive an hour's exposure to the sun. They are undoubtedly distributed by transport of infested plants.

Fumigants, nicotine sulphate used as a dip, and powdered sulphur and tobacco dusts were valueless as means of control, and treatment with dry or moist heat was fatal to the plants [but *cf.* xx, 429]. Dipping young plants in water at 115°F. for 5 minutes gave 98 per cent. control, but the method was not tried under field conditions. Only mite-free plants should be used for planting, and propagation of runners from infested plants should be avoided. In infested fields, the plants should not be cropped for more than two years, and they should then be ploughed in. If only a few plants are infested, they should immediately be removed. A new plantation should not replace an infested one for at least six weeks, as mites have been found to exist on buried plants for as long as four weeks.

THOMPSON (R. W.). **The Black Vine Weevil** (*Brachyrrhinus sulcatus* **Fab.) attacking Japanese Yew.**—*62nd Ann. Rep. Ent. Soc. Ontario* **1931**, pp. 37–39. Toronto, 1932. [Recd. March 1933.]

Otiorrhynchus (*Brachyrrhynus*) *sulcatus*, F. (black vine weevil) was found to be damaging *Taxus cuspidata* in a nursery in Ontario in June 1931. The larvae severed the primary roots of the seedlings and destroyed the small roots of the young trees, the larger ones being

decorticated. Material collected on 25th June consisted of 15 per cent. larvae, 50 per cent. pupae and 35 per cent. adults. Larvae and pupae were found $1\frac{1}{2}$–7 inches below the soil surface. There was an average of 6 adults per tree, which were nearly always in a group on the south side, either above the ground or below lumps of soil.

Experiments in cages and in the field were carried out to test the value of poison baits and various liquid contact or stomach poisons against the adults. The combination of a poisoned raisin bait [*R.A.E.*, A, xix, 528] and a lead arsenate spray (2 lb. to 40 gals. water), applied very thoroughly, gave the best results. The bait should be spread lightly and evenly over the seedling beds and round the bases of the young trees, and it should be replaced as soon as it dries.

Ross (W. A.). **History of the Oriental Fruit Moth Infestation in the Niagara Peninsula.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 40–43, 2 graphs. Toronto, 1932. [Recd. March 1933.]

This survey of the occurrence of *Cydia* (*Grapholitha*) *molesta*, Busck, in the Niagara peninsula, where it was first discovered in 1925, shows that although during 1927 and 1929 infestations of peach were severe, especially in the eastern end of the peninsula, there was a marked reduction in 1928, 1930 and 1931. The reduction in 1928 was not due to control measures or, apparently, to the action of parasites, and it is probable that physical factors supplemented the work of natural enemies in 1930 and 1931.

Hutson (R.). **Control Measures for Apple Tree Borers.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 46–47. Toronto, 1932. [Recd. March 1933.]

In experiments in 1930 and 1931, a paste composed of raw cottonseed oil and calcium cyanide [*cf. R.A.E.*, A, xx, 293, etc.] and a solution of 1 lb. paradichlorobenzene in 2 U.S. quarts raw cottonseed oil [*cf.* xix, 630], were employed against *Chrysobothris femorata*, F. (flat-headed apple tree borer) in Michigan. Both materials gave good control without injuring the trees ; they were applied in spring and autumn when the trees were not actively growing, by painting the darkened areas indicating the burrows or by injection into the burrows with a pressure grease gun. The painting method was preferable since it entailed less trouble, but in a test against *Saperda cretata*, Newm., in apple, the grease gun gave an equally good kill with less material. Powdered cyanide should be used in the latter method since the granular form settles into a mass that clogs the nozzle of the gun.

Marshall (J.). **Observations on the Trapping of Apple Maggot Flies.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 47–48. Toronto, 1932. [Recd. March 1933.]

An account is given of further experiments in Nova Scotia in the trapping of *Rhagoletis pomonella*, Walsh [*cf. R.A.E.*, A, xix, 758]. In July 1931, when the flies were abundant, 18 bait pans were suspended from the branches of a small apple tree, 3 being filled with water only and the remainder with water solutions of Clensel [*cf.* xix, 647, etc.] at concentrations of 1, 5, 10, 25 and 50 per cent. After 11 days, these had trapped 914 flies, as against 2 in the pans of water, but there

was an increasing number of oviposition punctures in the fruit, and at the end of the experiment the flies were still numerous on the trees.

Subsequent tests were made with mixtures intended to simulate Clensel, which is composed of fatty acids, free fat, essential oil, water, combined alkali, ammonia and glycerol, the odorous constituent probably being oil of citronella or geraniol. It was found that neither of the last two substances was attractive in an olfactory sense and that aqueous solutions of potassium oleate and triethanolamine oleate were as effective in catching the flies as Clensel. The attractive stimulus of Clensel and other soap solutions was apparently visual rather than olfactory, and was not felt at a greater distance than 12 inches. Although the flies appeared to be attracted to water, they invariably escaped from it, but saponin, ethyl malate and methyl malate lowered the surface tension sufficiently for them to be drowned. The attraction to water was probably phototactic, but the possibility of a chemopositive attraction is to be investigated. The scum on undiluted Clensel prevented it from trapping many flies. None of the tested substances was effective except when suspended within 12 inches of apple clusters; in one case a pan of 50 per cent. Clensel trapped 79 flies in two days. White pans were nearly twice as effective as grey ones.

CAESAR (L.). **The Apple and Thorn Skeletonizer** (*Simaëthis pariana* **Clerck**).—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 48–49. Toronto, 1932. [Recd. March 1933.]

A serious increase in the numbers of *Hemerophila* (*Simaëthis*) *pariana*, Clerck [*cf. R.A.E.*, A, xix, 42] occurred in Ontario in 1931, and in two counties especially, whole apple orchards were affected. The foliage of the trees in unsprayed orchards turned brown and died by the end of September, but in those that had received a calyx spray only, injury was chiefly confined to the terminal growth, and in those in which a special spray was applied against the apple maggot [*Rhagoletis pomonella*, Walsh] about 1st July, there was no injury even from late larvae, which were found up to the end of October.

It is not known whether the winter is passed as an adult, pupa or both. Moths were quite numerous on 31st October, but on 9th November, 59 pupae were obtained from 100 cocoons, and nearly all of them were alive, having withstood a temperature of 26°F. Adults emerged in 3 days from about 50 per cent. of a batch of cocoons brought indoors on 11th November. This emergence was remarkably rapid if the pupae were the overwintering form, but on the other hand if the autumn of 1931 had been colder, fewer adults would have emerged and more pupae would have remained to overwinter.

ROSS (W. A.). **The Status of Lubricating Oil Sprays in Ontario.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 49–57, 3 figs., 1 graph. Toronto, 1932. [Recd. March 1933.]

An account is given of the experimental and commercial use of lubricating oil sprays during eight years. Only cheap oils made to the stock emulsion formula [*R.A.E.*, A, xviii, 307] and having the characteristics already noticed [xvi, 331] are dealt with.

Most of the information on the use of these sprays against *Psylla pyricola*, Först. (pear psylla) has already been noticed [xv, 495, etc.].

The annual dormant application of 3 per cent. oil sprays during 6, 7, and 8 consecutive years has caused no injury to healthy pear trees and has not reduced the fruit yield. Experiments on the effect on them of dormant applications of 10 and 20 per cent. oil were begun in 1926 and continued for six years. The 10 per cent. spray slightly retarded leaf-bud development. The 20 per cent. spray caused no injury until the third year, when the leaf-bud development was greatly delayed and many of the buds were killed; fruit-bud development was also slightly delayed, but none of the flowers nor any of the wood was killed. The bud injury was probably more conspicuous since the trees were defoliated in the previous season by a severe infestation of *Psylla*. In 1929, 1930 and 1931, there was in addition, a scarcity of flowers on the lower part of the trees, and the lenticels were abnormally large; there was more sucker growth and less fruit on the sprayed trees, but all the trees were vigorous. It was found that the oil had only penetrated to the sublenticular tissues. The trees were not injured when temperatures as low as 20°F. followed applications, but no sprays were actually applied when the temperatures were low.

Experience with oil sprays against *Myzus cerasi*, F., on cherry [*cf.* xv, 37] under varied conditions of infestation for 7 years has shown that one annual application of 3 per cent. oil when the buds are beginning to open, supplemented by removal and destruction of infested water sprouts in June, gives excellent commercial control, without injuring the trees. Good results in the control of *Paratetranychus pilosus*, C. & F., on plums, have been obtained with 3 per cent. oil sprays applied in spring before the buds open. In 1927, damsons treated with delayed dormant 3 per cent. oil followed by two summer applications of Bordeaux mixture had 12 mites per 100 spurs, and those treated with 4 per cent. oil followed by Bordeaux had 5·7, whereas plots sprayed with lime-sulphur (1 : 7) followed by Bordeaux or lime-sulphur (1 : 40) had 7,144. There was no difference in toxicity between 3 per cent. oil in water and in Bordeaux mixture. In some seasons, better control is obtained if the oil is followed by summer sprays of lime-sulphur instead of Bordeaux. No injury to plum trees has occurred, but in 1927, 3 and 4 per cent. sprays on damsons retarded flowering to a slight extent, without, however, affecting the fruit yield or the vigour of the trees.

Against the apple leaf-rollers, *Tortrix* (*Archips*) *argyrospila*, Wlk., and *T.* (*A.*) *semiferana*, Wlk., a spray of 6 per cent. strength proved most satisfactory, when applied before the leaves began to show. A delayed dormant 3 per cent. oil in Bordeaux mixture has been applied annually to apple trees since 1928 without injury to the wood or retardation of bud development, but slight scorching of the leaves has occurred. When, however, the oil spray was followed by a "pink" spray of lime-sulphur (1 : 40), the leaves were severely scorched and became dwarfed and curled. This was largely prevented by substituting aluminium sulphate and lime-sulphur mixture for lime-sulphur, in pre-flowering applications.

MITCHENER (A. V.). **The Brown-headed Spruce Sawfly,** *Pachynematus ocreatus* (**Harr.**) **Marlatt.**—*62nd Ann. Rep. Ent. Soc. Ontario* ***1931***, pp. 57–61, 3 figs., 7 refs. Toronto, 1932. [Recd. March 1933.]

Observations on *Pachynematus ocreatus*, Harrington (brown-headed spruce sawfly) were made in Manitoba during the summers of 1928,

1929, 1930 and 1931, both in an insectary and in the field. All stages are described. The larvae were only observed infesting *Picea canadensis*, of which the new growth was devoured. The adults appeared between 28th May and 8th June, and oviposited in 1 or 2 days. The number of eggs in the ovaries of 17 females varied from 23 to 69. The eggs were laid near the base of the needles, one to each needle, and hatched in 7–9 days. The larval stage varied from 26 to 30 days, active larvae being observed as early as 8th June and as late as 15th July. The full grown larvae hibernated in cocoons in the débris on the ground or a short distance below the surface of the soil, pupating in the following May. Observations in 1931 indicated that the pupal stage is short and that the adults probably remain in the cocoons for a few days until favourable weather conditions occur.

The larvae were readily controlled with calcium arsenate thoroughly applied as a spray or dust about 15th June when they were small and the new growth was sufficiently advanced to retain it.

Balch (R. E.). *Dreyfusia piceae* (**Ratz.**) **and its Relation to "Gout Disease" in Balsam Fir.**—*62nd Ann. Rep. Ent. Soc. Ontario* ***1931***, pp. 61–65, 2 figs., 5 refs. Toronto, 1932.

Balch (R. E.). **The "Gout Disease" of Balsam Fir.**—*Forestry Chron.*, 1932, reprint 8 pp., 1 map, 5 refs. Toronto, February 1932. [Recd. March 1933.]

In the first paper an account is given of preliminary observations in Nova Scotia on the bionomics of *Chermes* (*Dreyfusia*) *piceae*, Ratz [*cf.* *R.A.E.*, A, xiii, 534 ; xiv, 340], made in consequence of the discovery in the autumn of 1931 that small numbers of this Aphid were invariably associated with the early stages of an abnormal condition of balsam fir (*Abies balsamea*) that had previously been thought to be due to a fungous disease.

The sistens larvae, which overwinter on the bark of the stems, branches and twigs, and in the latter position are generally found at the base of the buds or beneath the old scales at the first node, begin development in early spring. Oviposition commences in the fourth instar. One female laid 168 eggs, but the average number is probably smaller. The first eggs begin to hatch before the egg-mass is completed, and some of them give rise to progrediens larvae. These developed after four moults to winged adults following migration to the leaves, but the generation seems to be rudimentary since it has not been found to reproduce either on *Picea* or *Abies*. Most of the eggs, however, produce larvae of the sistens type ; some of these (hiemo-sistentes) hibernate, whereas others (aestivo-sistentes) develop after a short aestivation period and oviposit the same summer. The number of eggs laid by this generation averages probably not more than 30 per female, and these give rise to sistens larvae, which hibernate. Only two generations were observed. Progress of infestation is dependent on the wingless parthenogenetic adults, which are probably dispersed as eggs and newly hatched larvae by animals and by wind.

Observations on five species of *Abies*, both artificially and naturally infested, show that trees are susceptible at all ages, and that there are two kinds of injury, one to stems and the other to twigs. Larvae from eggs on the stem will, however, settle readily on the ends and at the bases of the new shoots. The abnormalities caused in the structure of

the twigs and stems are described. The twigs assume a swollen appearance, which is emphasised in severe infestations by suppression of bud development, but the degree of swelling bears no direct relation to the number of larvae present ; it is apparently dependent on the vigour of the infested plant. As growth continues, some individuals may remain at the nodes and others migrate to the new shoots. Sometimes the infestation will disappear and the tree will recover, but death usually results from continued attack. The larvae on the stems are found in crevices, at lenticels, etc., and their feeding causes the bark to become roughened by slight swellings in the neighbourhood of the lenticels. The trees may withstand stem injury for a number of years though many of those observed were dying.

The second paper contains a short account of the bionomics of *C. piceae* and the damage it causes, with notes on its control. The more serious attacks appear to have occurred in open stands. Miscible oil sprays may be used in nurseries and on ornamental trees if applied thoroughly at the time of hatching in spring. Control in the forest is at present impracticable. In isolated infestations in new areas the individual trees may be cut down and burnt. Where the pest is recognised in marketable stands, the trees should be cut during the winter (when active larvae and eggs are not present) before they die. No means of natural control has been found.

VAN STEENBURGH (W. E.). **The Parasites of the Oriental Fruit Moth (*Laspeyresia molesta* Busck) in Ontario 1931.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 66–69. Toronto, 1932. [Recd. March 1933.]

An account is given of further investigations on the parasites of *Cydia* (*Laspeyresia*) *molesta*, Busck, on peach in Ontario [*cf. R.A.E.*, xix, 754, etc.]. The marked increase in their numbers in 1931 was mainly responsible for a reduction in the damage effected by the pest. *Trichogramma minutum*, Riley, was first found parasitising eggs in the last week of June ; this was its earliest appearance since observations were begun in 1928 [xviii, 122]. On 9th July two orchards showed 20·5 and 42·5 per cent. egg destruction respectively and the parasite was constantly present after this date. A total of 3,810,000 laboratory bred individuals was released. In addition, 5,000,000 native dark individuals obtained from *Sialis* eggs collected from Prince Edward county were also liberated. The light and dark strains showed a marked difference in reaction to different degrees of temperature and humidity in the laboratory. The optimum temperature for the light strain was lower than for the dark, and the light strain lived longer under all conditions.

No new introductions of *Macrocentrus ancylivora*, Rohw., were made. Using *Ancylis comptana*, Froel., as host, 1,223 males and 1,895 females were bred, and in addition 769 males and 809 females were secured from infested twigs and fruits ; of these, 3,746 individuals were released on 10 areas. In addition to most of the larval parasites noticed in the previous report [xix, 754], *Elephantocera greenei*, Towns., and *Cremastus forbesi*, Weed, were obtained from material collected in the field. The percentages of parasitism by *M. ancylivora* and native species respectively were : 14·6 and 8·8 in first generation larvae in twigs ; 1·7 and 6·9 in those in fruits fallen in June ; and 20·7 and

67·3 in second generation larvae in twigs. There was a very marked increase of *Glypta rufiscutellaris*, Cress., and *C. minor*, Cush., parasitising larvae of the second generation, and almost complete parasitism of this generation.

STIRRETT (G. M.) & ARNOTT (D. A.). **Observations on the Outbreak of Sod Webworms during the Season of 1931.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 69–75, 1 fig., 20 refs. Toronto, 1932. [Recd. March 1933.]

A serious outbreak of various species of *Crambus* occurred in Ontario and parts of the United States in 1931. In Ontario, the injury was most severe in lawns, golf courses, pastures and meadows, though cultivated plants, including cereals and tobacco, were also attacked. *C. trisectus*, Wlk., *C. teterrellus*, Zinck., and *C. dorsipunctellus*, Kft., were the most important species attacking lawns and golf courses. The grass appears to die from lack of moisture, small brownish patches coalescing to form large areas, the size of which is directly dependent upon the number of individuals present. At the end of July, when the injury was well advanced, there were 12–15 larvae per square foot in one area, most of which were mature, and pupae were common. At the beginning of August, larvae were scarce, and pupae more abundant; and adults of *C. teterrellus* occurred in numbers on tree trunks and in the longer grasses, but had disappeared by 20th August. The larvae and pupae were found in the dead grass and crowns of the plants just above the soil surface. Light trap records in one area showed numerous adults of *C. trisectus* from 16th June to 14th July; these adults were scarce from 17th July to 1st August but were numerous again between 12th August and 15th September. Injury by second brood larvae was apparent in two areas during the middle of September, being probably caused by *C. trisectus* and *C. teterrellus*; the grass in these areas had been killed by 26th October. On one golf course, there were 200 larvae per square foot on 26th October. All kinds of grasses were eaten.

Larvae collected in the field showed 35 per cent. parasitism by 3 unidentified Hymenoptera. Birds attacked the larvae, but damaged the lawns in doing so.

Golf greens treated with lead arsenate ($2\frac{1}{2}$–3 lb. per 1,000 sq. ft.) in June were in good condition at the end of July, whereas untreated fairways were badly damaged. At the height of the outbreak the greens were again treated with lead arsenate (4 lb. to 1,000 sq. ft.), and these were only slightly injured by the second brood larvae in September.

Attacks on pastures have always been prevalent in Ontario and various species were reported from Quebec in 1916 [*R.A.E.*, A, vi, 63]. In a local but serious outbreak in Ontario in 1931, the larvae were parasitised by a species of *Empusa* and *Apanteles*. The adults present at the end of June were *C. hortuellus*, Hb., *C. laqueatellus*, Clem., and *C. trisectus*. *C. vulgivagellus*, Clem., was numerous later and was probably the commonest species, since all the larvae that matured in the laboratory were this species. These larvae aestivate in the summer and do not give rise to adults until August and September; light trap records showed the latter to be most numerous from 1st to 16th September. No control measures were attempted.

STIRRETT (G. M.). **Observations on the Outbreak of Green Clover Worm attacking Beans during the Season 1931.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 75–82, 28 refs. Toronto, 1932. [Recd. March 1933.]

Notes are given on the history and bionomics of the Noctuid, *Plathypena scabra*, F., in North America [*cf. R.A.E.*, A, xiii, 634]. The first serious outbreak in Canada occurred in Ontario in August 1931 when the plants attacked were various beans, clover and lucerne. In one county an average yield of 16 bushels of beans per acre was reduced to 12 by the infestation. The beans were small, deformed and scarred, resulting in a further loss of 5–10 per cent. in grading ; this is normally less than 2 per cent. The first larvae were found on 5th August, and by the 20th 73 per cent. had pupated and adults were emerging in large numbers. Nearly all the larvae had disappeared by 1st September. Pupation took place in the first inch of the soil or beneath dead leaves. Beans planted in the first week of June, which were just beginning to mature, were most severely damaged. The larvae fed on the leaves, mostly on the undersurface and on the upper third of the plant, and sometimes attacked the pods. Light trap records showed that the moths were on the wing from 5th July until 3rd October, and they were taken in bait traps until 26th October. The heaviest flight (light trap) occurred between 13th July and 3rd August.

Nothing is known of the insect in the spring and early summer of 1931, but the first generation probably developed on clover and lucerne, although no injury to these was reported until August.

On 20th August, 18·7 per cent. of the larvae in one field had been killed by a fungus, infestation by which was found to be distributed fairly evenly over the district. Adults that emerged from pupae collected on or after 20th August died in the cages without ovipositing.

Control measures recommended were : dusting with calcium or magnesium arsenate and hydrated lime (1 : 5), at the rate of 15–20 lb. per acre ; and spraying with 1 lb. calcium arsenate and 3 lb. lime in 40 gals. water, or 1 lb. magnesium arsenate in 50 gals. water, at the rate of 80–100 gals. per acre. Less than 5 per cent. of the growers used the sprays, but beneficial results were obtained in most cases and there were no reports of foliage injury. Very severely damaged fields should be ploughed to prevent the larvae and pupae from maturing.

KENDALL, jr. (E. W.). **Notes on the Onion Maggot** (*Hylemyia antiqua*, **Meigen**).—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 82–84. Toronto, 1932. [Recd. March 1933.]

The author's observations in Ontario on the biology of *Hylemyia antiqua*, Mg. [*cf. R.A.E.*, A, xvii, 425] have afforded some indication that the pre-oviposition period is occasionally shorter than the 7–11 days given by most observers, but that for control measures it may be safely assumed to be about a week. Treatment of onions should begin as soon as the plants appear above the soil. The larvae migrate from small dying plants to living ones, and in experiments, larvae of more than 7 days old could reach onions 10 inches away within 24 hours.

In 1930, adults of the overwintered generation at the peak of oviposition laid 176 eggs on 100 plants, whereas those of the first generation laid 1,688 eggs on the same plants without any appreciable injury.

being done by the larvae. The reasons for this seemed to be that 96·6 per cent. of the onions on which the second generation eggs were laid had been infested by the first generation, that the plants were larger, so that one would support 15 or more maggots, whereas a single first generation larva might destroy four, that fewer eggs hatched in July than in June owing to desiccation, and possibly that parasites had become established by July.

The use of mercury bichloride is favoured by growers rather than oil emulsion [*cf.* xix, 317, etc.] as the oil sometimes scorches the plants and causes more damage than the fly itself. The first application causes the most injury, but by the time of the third application the plants seem to be able to withstand a spray stronger than 2 per cent. Growth is stimulated with mercury bichloride in dry weather, probably owing to the additional watering. This measure is slightly more expensive but easier to apply.

DUSTAN (A. G.) & MATTHEWMAN (W. G.). **Notes on *Taeniothrips gladioli* Moulton and Steinweden.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 84–87. Toronto, 1932. [Recd. March 1933.]

Taeniothrips gladioli, Moult. and Stnw., was first discovered in Canada in 1930 [*R.A.E.*, A, xix, 310], since when it has been prevalent in Ontario and Quebec, being also reported from Nova Scotia, New Brunswick and Manitoba.

In the winter of 1930–31 the thrips was found to breed readily on stored corms of *Gladiolus* if these were kept at about 70°F., and extensive feeding weakened and disfigured the corms. In fumigation tests, complete control was obtained with a mixture of ethylene dichloride and carbon tetrachloride (3 : 1) applied at the rate of 14 lb. per 1,000 cu. ft. for 24 hours at 70°F., without injuring the corms.

In the Ottawa district in the summer of 1931, the adults first appeared inside the leaf sheaths when the plants were 6 ins. high and continued feeding there in early summer. They were present in the flower spike when it formed ; and as soon as the flowers appeared most of them congregated beneath the sepals and in and around the petals. In heavy infestations the flowers did not open, and whole fields appeared as if scorched by fire. The foliage injury was similar to that caused by other thrips, the leaves having a silvery appearance, especially at the tips. After flowering was over the adults returned to the leaves and stems, and at the approach of cold weather migrated to the corms. At this time, they were abundant in the soil, but from 1st October their numbers decreased and by the end of the month they had practically all disappeared. Catches on screens covered with an adhesive demonstrated that migration from the field took place gradually during September and October. In November no thrips were found in the soil, and search in possible hibernating media gave negative results.

Ten different sprays and dusts were tested at weekly intervals during August, at the height of the infestation, the majority having no effect. The best results were obtained with 2 tablespoons Paris green and 2 lb. brown sugar in 3 gals. water. Control is difficult because the adults are well sheltered and the sprays run off the waxy epidermis of the plants. Fumigation with calcium cyanide, under an oilcloth tent, at the rate of 6 oz. per 1,000 cu. ft. for 1 hour gave excellent control ; it was always carried out at 80°F. or more. Slight spotting of the flowers occurred, but in practice the plants would be fumigated before

flowering. Immersing the corms in autumn in dips containing nicotine sulphate or mercury bichloride was not effective, but 100 per cent. control was obtained with 1 lb. fish-oil soap in 40 gals. water after soaking for 3 hours. The effect on the corms has not been determined.

All refuse should be cleared from the gladiolus beds and burnt. Deep ploughing or digging should be practised in the autumn. Corms should be stored at as low a temperature as possible and fumigated in spring, and the plants should be sprayed at weekly intervals as soon as the thrips appears in early summer.

THOMPSON (R. W.). **Notes on Control Substances for Sowbugs.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 87–89. Toronto, 1932. [Recd. March 1933.]

A heavy infestation of woodlice, probably *Porcellio laevis*, Latr., occurred in a rubbish dump on the outskirts of a town in Ontario in 1931. They migrated at night to houses in the vicinity and crawled over food kept in the cellars. The results of laboratory tests with 23 different materials against them are stated briefly. Plots in the infested dump were treated with paradichlorobenzene ($1\frac{1}{4}$ lb. per 100 sq. ft.), or baits of Paris green and brown sugar (1–40) or Paris green, bran and syrup. These all resulted in some reduction of the pest, but the infestation was eventually controlled by covering the dump with slag to a depth of six inches ; this was pounded down and left to harden.

CAESAR (L.). **The European Corn Borer Situation in Ontario in 1931.**—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 89–91. Toronto, 1932. [Recd. March 1933.]

An account is given of a survey conducted during 1931 to determine the economic status of the European corn borer [*Pyrausta nubilalis*, Hb.] in Ontario [*cf. R.A.E.*, A, xix, 476]. In spite of weather favourable to the borer, there was no increase where the provisions of the Corn Borer Act [xvii, 394 ; xviii, 119] were properly carried out, and little damage was done.

MARCOVITCH (S.). **How to combat certain Pests of the Household.**—*Bull. Tennessee Agric. Expt. Sta.*, no. 147, 19 pp., 12 figs., 9 refs. Knoxville, Tenn., February 1933.

These recommendations for the control of household insects include some based on the results of recent work with fluorine compounds. The soaking of woollens, including carpets, upholstered furniture, etc., with a solution of 1 oz. sodium fluosilicate to 1 U.S. gal. water protects them against clothes moths (*Tinea pellionella*, L., and *Tineola bisselliella*, Humm.), *Lasioderma serricorne*, F., and *Anthrenus scrophulariae*, L. Sodium fluosilicate scattered as a dry powder is recommended against cockroaches and book lice (*Atropos*), and *Lepisma saccharina*, L. (silverfish) may be controlled by using it as a bait with 5–8 parts flour. Barium fluosilicate has also given good results against cockroaches, sodium fluoride being less toxic.

Entomology.—*Bienn. Rep. Utah Agric. Expt. Sta.*, Bull. 235, pp. 55–59, 4 figs. Logan, Utah, August 1932. [Recd. April 1933.]

Most of the information in this report has already been noticed [*R.A.E.*, A, xx, 470, 534, 679]. There were 3–4 generations of

Paratrioza cockerelli, Sulc (potato Psyllid) [*cf.* xix, 556] in Utah in 1931. In May 1932, 228 adults were collected in 100 sweeps of the net from *Lycium halimifolium*. No parasites of this Psyllid were observed, but Coccinellids, Chrysopid larvae and, in one instance, an Anthocorid were predacious on it. Great summer heat apparently retarded its development in July and August. The percentage of infestation by *Harmolita grandis*, Riley, in 1931 [*cf.* xix, 485] was 29·31 in irrigated and 19·64 in dry-farm wheat.

SMITH (R. C.) & KELLY (E. G.). **A Summary of the Population of injurious Insects in Kansas for 1932.**—*J. Kansas Ent. Soc.*, vi, no. 2, pp. 37–60, 1 pl., 2 refs. McPherson, Kans., April 1933.

The information is given based on questionnaires as in the previous year [*R.A.E.*, A, xx, 533].

Entomology & Plant Pathology.—*Bull. Maine Agric. Expt. Sta.*, no. 360, pp. 189–193, 195–197. 1 fig. Orono, Me., December 1931. [Recd. April 1933.]

C. R. Phipps records damage to buds of blueberry (*Vaccinium*) by adults of the Melolonthids, *Serica sericea*, Ill., and *Dichelonycha testacea*, Kby. Phipps and J. H. Hawkins report the first conspicuous outbreak of the corn ear-worm [*Heliothis obsoleta*, F.] in Maine for 10 years. Phipps describes various studies of the apple fruit-fly [*Rhagoletis pomonella*, Walsh]. Since observations on marked flies showed that they travel readily 150 yards or more, it is recommended that neglected apple trees within 200 yards of orchards be sprayed or cut down. The time and extent of emergence varied greatly with locality, soil type and especially fruit variety, very few developing on late varieties. It was found that the pupal stage occasionally lasted over two winters; on the other hand a few flies emerged in autumn a few weeks after pupation.

D. Folsom found that the spread of leaf-roll in potatoes was reduced but not eliminated by roguing, since Aphids were already present when the plants were only a few inches high. In experiments with field cages, leaf-roll was transmitted by *Macrosiphum gei*, Koch (*solanifolii*, Ashm.) [*cf.* *R.A.E.*, xix, 640] more readily than mosaic, but only to young plants. Attempts to transmit leaf-roll by *Lygus pratensis*, L., and *Epitrix cucumeris*, Harr., gave negative results. Experiments described by E. S. Schultz, R. Bonde and W. P. Raleigh showed that *Myzus persicae*, Sulz., was a more effective carrier of mosaic, leaf-roll and spindle-tuber than *Aphis rhamni*, Boy. (*abbreviata*, Patch) or *Macrosiphum gei*. *E. cucumeris* and *Leptinotarsa decemlineata*, Say, but not *Lygus pratensis*, transmitted spindle-tuber. None of the three transmitted leaf-roll or mosaic.

BERGER (E. W.). **The Latest concerning Natural Enemies of Citrus Insects.**—*Proc. Fla. St. Hort. Soc.*, 1932, reprint 4 pp. [? Deland, Fla., 1932.] [Recd. April 1933.]

An increase in effectiveness of the natural enemies of insect pests of *Citrus* in Florida in 1932 is thought to have probably been due to the favourable climatic conditions prevailing during the winter of 1931. From numerous colonies of *Leis conformis*, Boisd., which was introduced from California against *Aphis spiraecola*, Patch (green citrus aphis) [*R.A.E.*, A, xvi, 196] and reared and liberated in many parts of

the State in 1925, only one appears to be established [*cf.* xviii, 246]. Its survival is considered to be due to the succession of Aphids on tangerines of various ages, some of which are apparently succulent throughout the year. Reference is made to the introduction of *Cryptolaemus montrouzieri*, Muls., against mealybugs [xx, 647]. About 200–250 colonies of *Rodolia cardinalis*, Muls., are distributed to growers each year for use against the cottony cushion scale [*Icerya purchasi*, Mask.] at a cost of about 4*s.* per colony of 10 individuals, resulting in an estimated saving of about £900,000 [at par] in expenditure for spraying *Citrus* alone.

In a discussion of entomogenous fungi attacking insects injurious to *Citrus* and other plants, 16 species are mentioned that attack whiteflies, armoured and soft scales, the Florida wax scale [*Ceroplastes floridensis*, Comst.], the citrus mealybug [*Pseudococcus citri*, Risso], the rust mite [*Phyllocoptes oleivorus*, Ashm.], *I. purchasi* and *A. spiraecola* [*cf.* vii, 20 ; xii, 587]. Their effective use depends on periods of moisture and warmth, and heavy cover crops are of considerable value in conserving the necessary degree of humidity for them. The distribution of cultures of red *Aschersonia* [*A. aleurodis*] against whiteflies at a cost of about 4*s.* per culture is being continued [viii, 384]. By the fact that they enable growers to dispense with at least one application of an oil spray, entomogenous fungi effect an annual saving of about £530,000.

WILSON (J. W.). **The Biology of Parasites and Predators of *Laphygma exigua* Huebner reared during the Season of 1932.**—*Florida Ent.*, xvii, no. 1, pp. 1–15, 10 figs., 13 refs. Gainesville, Fla., 15th March 1933.

Notes are given on the natural enemies of *Laphygma exigua*, Hb., reared during a study of its biology and control on *Asparagus plumosus* in Florida [*R.A.E.*, A, xxi, 80]. The Ichneumonid, *Hyposoter interjectus*, Gahan, the pupal case and adult of which are described, is thought possibly to be only an occasional parasite. Larvae from eggs parasitised by *Chelonus texanus*, Cress., developed normally to the third or fourth instar and attempted to pupate, the larvae of the Braconid emerging 12–15 days after parasitism had occurred. The adults feed at the nectaries of cotton and other plants. *Apanteles marginiventris*, Cress., is found abundantly in the ferneries and appears to be widely distributed in the southern States. It generally oviposits in the first instar caterpillars before they disperse. The parasite larva usually emerges from the fourth instar host, and pupates in a cocoon attached to the upper surface of a spray of asparagus, the adult emerging in an average of 3·3 days. *Meteorus autographae*, Mues., is also abundant and was present in the fernery from June to September inclusive. Adults emerged from cocoons formed in the insectary after 6 days and usually oviposited in the larvae of the second or third instar. Reproduction may take place parthenogenetically, the progeny being males. The cocoon is attached by a single long thread to the asparagus spray. The Chalcids, *Spilochalcis hirtifemora*, Ashm., and *S. albifrons*, Walsh, and the Pteromalid, *Catolaccus aenoviridis*, Gir., emerged from cocoons of *A. marginiventris* collected in the fernery, but these hyperparasites do not apparently reduce its numbers appreciably.

The Eulophid, *Euplectrus platyhypenae*, How., is a gregarious external parasite and has been reported from a number of Noctuids, a list of which is given. It is thought that the systematic application of lead

arsenate possibly reduces its numbers, as the females prefer to oviposit on the larvae of the third or fourth instar, the eggs being laid in groups of 3–30. From June to September inclusive at an average temperature of 81·4°F. the incubation period averaged 2·28 days, and in November and December at 63·2°F. it lasted 8 days. During the former period, 9 generations were reared and the larval period averaged 3·53 days; larvae of the twelfth generation matured in 9·75 days. The host caterpillars did not moult, though they fed normally throughout the larval development of the parasite. The host is usually in a weakened condition when the parasite larvae are mature, and they then attach it to the breeding cage or the asparagus spray by coarse threads, which help to hold them in place throughout their pupal period. The pupal stage lasted an average of 4·39 days during the first nine generations and required 15·25 in December at an average temperature of 63·2°F. The adults are long lived. In Florida, development continues throughout the winter, though at a relatively slower rate. Parthenogenetic reproduction may occur, the progeny being males. In all generations females predominated. The Vespid, *Polistes rubiginosus*, Lep., was present in the ferneries in large numbers during the summer; the method by which it captures and prepares the larva for transportation to the nest is described by Mr. Goff.

The Pentatomid, *Podisus maculiventris*, Say, was abundant from the latter part of June to the latter part of August. The adults live for long periods and feed voraciously; one that was captured on 26th June lived till 4th September, having consumed 122 larvae of *L. exigua* of the fourth and fifth instars. The eggs, which are deposited in masses on the asparagus spray or other convenient places, hatched in an average of 5·08 days at an average temperature of 78·8°F. in September, three females laying totals of 871, 238 and 768 eggs. The nymphs are gregarious for 2–3 days and feed on the tender shoots of the asparagus fern (without apparently injuring the plants) before attacking the smaller larvae. Nymphal development was completed in 20–23 days during the latter part of August (at about 84°F.) and the first part of September, and three generations were reared from August to 20th December.

Enormous numbers of larvae of *Laphygma* in all stages were killed by the fungus, *Spicaria prasina*, in wet weather.

WATSON (J. R.). **An Outbreak of *Mocis repanda* Fabr.**—*Florida Ent.*, xvii, no. 1, p. 15. Gainesville, Fla., 15th March 1933.

Remigia punctularis, Hb. (*Mocis repanda*, auct.) is commonly found in grasslands in Florida, but had not been observed in very large numbers prior to September and October 1932, when the larvae caused the complete defoliation of various grasses, particularly in the central part of the State.

ADAIR (H. S.). **Black Pit of the Pecan and some Insects causing it.**—*Circ. U.S. Dept. Agric.*, no. 234, 14 pp., 8 figs., 11 refs. Washington, D.C., August 1932. [Recd. April 1933.]

A condition known as black pit, which causes the shedding of immature pecan nuts, occurs wherever the trees are grown and sometimes results in considerable loss. Affected nuts are black on the inside, with little or no evidence of injury on the outside. Investigations in Texas,

begun in 1926 [*cf. R.A.E.*, A, xvii, 165], showed that both mechanical and insect punctures cause the condition if made in nuts while still in the watery stage, provided that the punctures extend to the watery portion of the nut. Insect punctures made in the nuts after the meat of the kernel had formed produced kernel spot.

Insects known to cause the true black pit condition are the Pentatomids, *Euschistus euschistoides*, Voll., and *Nezara viridula*, L., and the Coreids, *Leptoglossus phyllopus*, L., and *L. oppositus*, Say. The adults of *Curculio caryae*, Horn (pecan weevil) puncture pecans in feeding and cause black pit, but the punctures are larger and are easily located. Interior discoloration and subsequent dropping of immature nuts have also been observed where injury has been caused by the larvae of *Acrobasis caryae*, Grote, *Enarmonia* (*Laspeyresia*) *caryana*, Fitch, and *Conotrachelus juglandis*, Lec., but the damage is evident on the surface of the nuts and easily identified.

Studies on *E. euschistoides* and *L. phyllopus*, which are the commonest of the bugs on pecan in central Texas, were conducted during 1928. It was found that the adults of the last generation of the former mature during late summer and early autumn and feed until early winter. They then hibernate in bunches of grass or under leaves, pieces of bark or other débris, emerging at the end of March or in April. The eggs are deposited in clusters of about 28. Two females observed in summer began to oviposit 41 and 34 days after they matured and lived 65 and 44 days in all, each laying four egg clusters. The egg stage during midsummer lasts about 5 days and the nymphal stage 30. Breeding occurs on *Cirsium virginianum*, *Centaurea americana*, cowpeas, beans, squash, and tomato, and the adults feed on the fruits of a number of plants, including pecan, and also on the stems and shoots of succulent plants. Only two generations occurred in Texas during 1928, the first maturing in June and July.

L. phyllopus also hibernates as an adult. The life-cycle requires approximately 54 days, 9 as egg and 45 as nymph. The eggs are deposited in single rows on stems or leaves. Records obtained from 4 females showed preoviposition and oviposition periods of 8–13 and 3–42 days, with a total adult life of 24–68. Averages of 5·2 egg masses were laid with 27·7 eggs in each Only two generations occurred in Texas in 1928. The adults appeared in the field on about the same dates as those of *E. euschistoides*, and were found breeding on the same plants and also on peach. Additional food-plants recorded by other investigators are *Yucca flaccida* and *Datura tatula*, and the adults feed on a variety of other plants.

The eggs of *E. euschistoides* were parasitised by *Telenomus dimmocki*, Ashm., which is abundant during late summer, and those of *L. phyllopus* by *Hadronotus atriscapus*, Gahan. The adults of *L. phyllopus* were attacked by a Tachinid, probably *Trichopoda pennipes*, F. The control measure recommended is the elimination from the vicinity of pecan orchards of the plants on which the bugs are known to breed.

O'Kane (W. C.), Westgate (W. A.) & Glover (L. C.). **The Performance of Certain Contact Agents on Various Insects. Studies in Contact Insecticides V.**—*Tech. Bull. New Hampshire Agric. Expt. Sta.*, no. 51, 20 pp., 17 graphs, 5 refs. Durham, N.H., June 1932. [Recd. April 1933.]

The following is the authors' summary of a paper which is the fifth of a series [*cf. R.A.E.*, A, xx, 406] : This bulletin summarises the results

of a series of studies in which the contact angles of several so-called "wetting agents" on a number of species of insects were measured. The contact agents included sodium laurate, triethanolamine oleate, sodium oleate, saponin and Penetrol. Fifteen species of insects were used. Sources of error in measurements of contact angles on the surface of an insect are pointed out. Surface tensions were measured and contact angles on paraffin-coated slides were determined.

The materials studied gave definite variations in contact angles on the various species of insects. Sodium laurate at 0·25 and 0·5 per cent. gave in general optimum performance, but was inferior to some other contact agents in the case of three species of insects. Saponin solution was notably inferior. Triethanolamine oleate and Penetrol gave favourable contact angles on some insects but unfavourable on others. Certain insects, such as the squash bug [*Anasa tristis*, DeG.] and two species of grasshoppers, considered resistant to contact insecticides, gave distinctly unfavourable contact angles with all materials studied. Certain other insects, such as larvae of two species of sawfly of the genus *Diprion* (*Neodiprion*), gave distinctly favourable contact angles. The adults of the house-fly [*Musca domestica*, L.] showed definitely favourable results in the case of the soaps used. The data given indicate that the nature of the insect integument is an important factor in angle of contact studies.

Gross (C. R.). **Interference of Pyridine Derivatives in Arsenic Determination.**—*Industr. Engng. Chem.*, Anal. Edn., v, pp. 58–60, 3 graphs, 3 refs. Easton, Pa., 15th January 1933.

Organic products of plant or animal origin are usually analysed for arsenic by the Gutzeit method, the material first being digested with nitric and sulphuric acids in order completely to oxidise the organic matter and place the arsenic in solution. This method gives very low yields when used for the determination of arsenic in tobacco. Investigations showed that the pyridine ring of the nicotine molecule is the specific cause of the low results, and that interference of this sort is not necessarily confined to tobacco, but can be expected during the analysis of any product containing pyridine or its derivatives. A method for eliminating the interfering compounds is described in which the arsenic is precipitated with the phosphate by treatment of the digested solution with ammonium hydroxide, phosphoric acid and magnesia mixture. The precipitate containing the arsenic can then be washed free from the soluble pyridine residues, redissolved in a hydrochloric acid solution and analysed by the Gutzeit method. The method, as modified and simplified for use in analysing tobacco, is described. A distinct relation exists between the yields of arsenic obtained and the amount of the pyridine compound present. Much lower results were caused by nicotine during routine tobacco analysis than when the digestions were made with pure nicotine, which would indicate that the method of nicotine analysis does not detect all the interfering compounds present in tobacco. Apart from tobacco, there are few products analysed for arsenic that are likely to contain pyridine derivatives in amounts sufficient to affect the results of analysis, but it is possible that apples sprayed late in the season with nicotine sulphate may contain nicotine residues sufficient to interfere with the determination of arsenical residues deposited during previous sprayings with lead arsenate.

Quarantine No. 41. Quarantine on Account of the European Corn Borer and other dangerous Insects and Plant Diseases with revised Regulations. Revised Rules and Regulations supplemental to Notice of Quarantine No. 41 (Second Revision), governing the Importation of Indian Corn or Maize, Broomcorn and Seeds of related Plants.—*U.S. Dept. Agric., B.P.Q., Q. 41*, 5 pp. Washington, D.C., 1st March 1933.

Considerable modifications are made in the restrictions governing the entry into the United States of maize and certain allied plants on account of *Pyrausta nubilalis*, Hb. [*R.A.E.*, A, xiv, 390]. Articles manufactured from cobs, or other parts of maize, and maize silk are now relieved of all restriction except liability to inspection. Green maize on the cob may be imported, in small lots for local use only, from adjacent areas of Canada. Commercial shipments of maize in the cob, green or mature, from the Provinces of western Canada that are free from *P. nubilalis*, and shelled maize and seeds of the other plants covered by this quarantine from any part of Canada, are permitted entry under proper safeguards. As *P. nubilalis* appears to be absent from the West Indies, Bermuda, Mexico and Central and South America, the import of maize on the cob, green or mature, is now permitted from these areas. The import of broom corn [*Sorghum*] for manufacturing purposes, brooms or similar articles made of it, clean shelled maize, and clean seed of the other plants covered by this quarantine is also permitted under certain conditions of entry.

Steer (W.). **Studies on *Byturus tomentosus* Fabr. III. Further Experiments on its Control on Raspberries, Loganberries and Blackberries.**—*J. Pomol. Hort. Sci.*, xi, no. 1, pp. 19–38, 7 figs., 2 refs. London, March 1933.

Experiments in south-eastern England in 1932 confirmed the value of a derris spray against *Byturus tomentosus*, F., on raspberries and loganberries [*cf. R.A.E.*, A, xx, 331 ; xxi, 170]. Two applications (the first on raspberries 10 days and on loganberries 10–15 days after flowering began, and the second 10–15 days later) of a spray containing 0·005 per cent. rotenone and 0·5 per cent. soft soap reduced the percentage of infested fruit from 78·8 to 4·9 on raspberries and from 93·9 to 35·6 on loganberries. The percentage on raspberries was further reduced to 0·4 by using a spray of double the rotenone content and that on loganberries to 23·2 by delaying the applications from 14th and 24th to 18th and 27th June. Furthermore the percentage of only slightly infested loganberries was higher on the sprayed than on the unsprayed bushes (23·2 or 17·2 as against 7·7), and the average number of berries per lb. of ripe fruit was only 121 as against 206. The omission of the first spray gave results very little inferior (6·4 : 78·8 on raspberries and 23·9 : 91·4 on loganberries). On loganberries both methods showed a slight decrease in efficiency in the latter part of the picking season, and it might be better to omit the first (mid-June) spray and substitute a second spray between 5th and 10th July, shortly before picking. The higher control on raspberries may be due to the habit of the larvae of feeding on the tips of the young canes, where they are more accessible to a late June spray, whereas on loganberries a greater number remain in the fruit.

Three applications on raspberries of a dust containing 1·6 per cent. derris (or 0·09 per cent. rotenone), on 13th, 20th and 27th June, proved

less effective, reducing the percentage of infestation from 75·5 to 12·5, although the dust was apparently more toxic to the adult beetles. The China clay carrier used with it left traces of a white deposit, especially on earlier pickings. Two late applications (27th June and 2nd July) of a spray containing 0·05 per cent. nicotine and 1 per cent. soft soap reduced infestation of raspberries from 78·8 to 5·1 per cent., but was more expensive than the derris spray. Estimates are given of the cost of the various treatments.

In preliminary experiments on blackberries, the derris spray containing 0·005 per cent. rotenone applied in the 1st and 3rd weeks of July, or earlier with very early varieties, gave almost complete control.

KEARNS (H. G. H.) & WALTON (C. L.). **The Control of the Loganberry and Raspberry Beetle** (*Byturus tomentosus*). **Experiments with Pyrethrum and Derris Washes and Dusts.**—*J. Pomol. Hort. Sci.*, xi, no. 1, pp. 39–52, 9 refs. London, March 1933.

Experiments were conducted in south-western England to test the relative efficacy of preparations of derris [*cf.* preceding paper, etc.] and of pyrethrum extract [*cf. R.A.E.*, A, xviii, 498 ; xix, 178] in the control of *Byturus tomentosus*, F. Two derris sprays were used, containing respectively 0·0086 and 0·0043 per cent. of rotenone in a soap solution (10 lb. to 100 gals. water), and two pyrethrum sprays, at strengths representing 1·0 and 0·25 per cent. by weight of the dried flowers in a white oil emulsion at an oil concentration (in the stronger form) of 1·5 per cent. On raspberries a percentage infestation of 49·3 was reduced to 4·8 and 5·0 by the derris sprays, and to 24·8 and 32·4 by the pyrethrum emulsions, the higher concentration being the more effective in each case. On loganberries the corresponding figures were: 51·7, 2·8, 3·3, 14·8 and 26·5. Other pyrethrum emulsions, including the "Long Ashton formula" [xvii, 536 ; xviii, 595], gave more or less similar results. Atomised pyrethrum and kerosene sprays and an emulsion of derris in rape oil were much less effective. Two sprayings are recommended, the first 10–12 days after one-third of the total flower buds are fully open and the second 10 days after the period of full bloom. The weaker sprays appeared to be as effective as the stronger ones at the time of application, but, since their toxicity did not last so long, they did not kill so many of the later larvae as they hatched. In a wet season their effect would presumably wear off much sooner. Another experiment showed that in seasons (such as 1932) in which the adult beetles cluster in large numbers on the unopened and opening flower buds, they may be effectively dealt with by a derris dust containing at least 0·18 rotenone, but it is not considered advisable to depend on killing the adults only.

KEARNS (H. G. H.) & WALTON (C. L.). **A Note on the Control of the Raspberry Beetle** (*Byturus tomentosus* **Fabr.**) **by means of a Barium Silicofluoride Wash.**—*J. Pomol. Hort. Sci.*, xi, no. 1, pp. 77–80, 7 refs. London, March 1933.

Though pyrethrum and derris have both given satisfactory results against *Byturus tomentosus*, F. [see preceding papers], their toxicity depends on the presence of organic compounds, which cannot be so easily stabilised and standardised as inorganic ones. In view of the dangerous residue left by lead arsenate, experiments were therefore made with a spray of 12 lb. barium fluosilicate and 10 lb. soft soap in

100 gals. water. A single application on 22nd June (8 days after all the flowers were open) reduced the percentage infestation of raspberries from 29·2 to 4·7, as compared with 24·4 after a pyrethrum spray. The fluosilicate did not produce any visible deposit on the berries or foliage, but scorched a number of the leaves on the fruiting canes.

KEARNS (H. G. H.) & WALTON (C. L.). **The Adult Raspberry Beetle as a Cause of serious Blossom Injury.**—*J. Pomol. Hort. Sci.*, xi, no. 1, pp. 53–55, 1 pl., 4 refs. London, March 1933.

From observations made in south-western England in 1932 it was evident that the weights of certain raspberry crops were reduced more through damage done by the adults of *Byturus tomentosus*, F., than by the larvae. The adults attack the unopened buds, the stamens, nectaries and petals of the flowers and the unripe fruit. They are usually on the wing in numbers, frequenting apple, pear and other blossoms, some time before the raspberry and loganberry flowers open. In 1932, when they did more damage than usual, most of the apple blossom had fallen before many of the raspberry flowers opened.

HARRIS (R. V.). **The Strawberry "Yellow-edge" Disease.**—*J. Pomol. Hort. Sci.*, xi, no. 1, pp. 56–76, 4 pls., 2 figs., 25 refs. London, March 1933.

The affection of strawberry leaves, called by the author "yellow-edge" and possibly identical with the American "xanthosis," is shown by experiment to be a virus disease transmissible by grafting in the absence of insects. The discoloration and distortion of the leaves caused by the disease has not hitherto been clearly distinguished from symptoms directly due to infestation by the Aphid, *Capitophorus fragaefolii*, Ckll. (*fragariae*, Theo.) [*R.A.E.*, A, xvi, 408] or the mite, *Tarsonemus fragariae*, Zimm. [xiv, 177].

WADSWORTH (R. V.). **Cacao Beans and** *Ephestia elutella*.—*Trop. Agriculture*, x, no. 4, pp. 97–100. Trinidad, April 1933.

An account is given of the results of investigations undertaken in England to determine the factors associated with infestation of stored cacao by *Ephestia elutella*, Hb. [*cf. R.A.E.*, A, xviii, 427], and the types of cacao from different countries are discussed in relation to their susceptibility to attack. The moths usually lay their eggs in crevices in the neighbourhood of the beans, and the young larvae migrate, sometimes for 1–2 days, in search of soft food that will also provide shelter. No damage is caused to beans that have been properly fermented and the shells of which are intact, and infestation occurs in defective samples such as unfermented beans, the shells of which are entirely destroyed, and cut, broken, cracked or germinated beans, into which the larvae can penetrate. The proportion of such beans in a consignment may be taken as an indication of the maximum infestation possible.

The formation of a free space at the top of sacks stored on end provides conditions conducive to pupation and subsequently to flying and mating, and this may be prevented by placing the sacks on their sides, when the beans will fill the available space. Absolute cleanliness in the storehouse and the regular brushing and whitewashing of the

walls and roof are recommended. The defects that encourage infestation by *E. elutella*, which are also disliked by the manufacturers for other reasons and which could mostly be dealt with on the plantation, are briefly discussed.

SMITH (K. M.). **The Present Status of Plant Virus Research.**—*Biol. Rev.*, viii, no. 2, pp. 136–179, 1 pl., 10 pp. refs. Cambridge, April 1933.

The author gives a brief survey (pp. 151–152 and 177) of the literature dealing with the transmission of virus diseases of plants by insects, subsequent to his previous review of the subject [*R.A.E.*, A, xix, 583].

FAES (H.), STAEHELIN (M.) & BOVEY (P.). **Les traitements effectués contre les parasites des arbres fruitiers, insectes et champignons, en 1930 et 1931.**—*Landw. Jahrb. Schweiz*, xlvii, no. 1, pp. 17–76, 31 figs., 5 refs. Berne, 1933. [With a Summary in German.]

In experiments in Switzerland, winter spraying of apple and pear trees with soluble carbolineum (10 per cent.) was more effective than with any other commercial product in clearing the trees of mosses and lichens, which, besides hindering growth, harbour various insect pests. It effectively destroyed hibernating adults of *Eriophyes pyri*, Pgst. [*R.A.E.*, A, xxi, 115] and eggs of *Cheimatobia brumata*, L., which together with *Hybernia defoliaria*, Cl., was also dealt with by adhesive bands. Winter application of an oil emulsion, with or without caustic soda [xvii, 258], failed in the field to give satisfactory control of *Hyponomeuta malinellus*, Zell., on apple.

Observations in 1930–31 showed that a second brood of *Cydia* (*Carpocapsa*) *pomonella*, L. [xviii, 604] occurs in certain seasons, at any rate in low-lying districts of Switzerland. Where there was only a single brood, the customary two applications of a lead arsenate spray were effective. Against second-brood eggs a good control was obtained by summer oils such as $1\frac{1}{2}$ per cent. Volck. These may be combined with Bordeaux mixture containing 1 per cent. copper sulphate, but foliage injury is probable if oil and lime-sulphur are applied within 15 days of each other. Information is given on *Anthonomus rubi*, Hbst., most of which has already been noticed [xxi, 115]. Cockchafers (*Melolontha*) were completely deterred from ovipositing in part of a vine-nursery treated with 540 lb. crude naphthalene per acre.

SCHWERDTFEGER (F.). **Die Forleule in Neuendorf 1932. Untersuchungen über ihre Oekologie, Epidemiologie und Bekämpfung.** [The Pine Moth in Neuendorf in 1933. Investigations on its Ecology, Epidemiology and Control.]—*Mitt. Forstwirtsch. u. Forstwiss.*, 1932, pp. 342–404, 33 figs., 39 refs. Hanover, 1932. [Recd. March 1933.]

Infestation of pines by *Panolis flammea*, Schiff., is expected to increase in 1933 in various areas of Prussia, including that of Neuendorf, where these investigations were made in 1931–32. The control measures undertaken have already been noticed [*R.A.E.*, A, xxi, 38]. The emergence of the moths did not appear to be affected by temperature or rainfall. The males tended to emerge earlier than the females in the field in April and May, whereas the contrary obtained at high temperatures in the laboratory in February and March. The

moths emerged at a fairly uniform rate between 1 a.m. and 9 a.m. in the laboratory. From numerous observations, it is almost certain that the chief factor affecting the beginning of flight is a certain degree of twilight, so that it depends on the hour of sunset and on the denseness of the clouds. Temperature was of less importance, though flight occurred more readily and began earlier on warm evenings. Humidity, air-pressure and rainfall had no apparent influence, but the effect of heavy rain was not ascertained. The moths flew in greater numbers in a slight breeze than in calm air or a strong wind.

Larval feeding continued for about 8 weeks (24th May–18th July) and reached its peak in the 6th week. The rate of feeding was fairly uniform throughout the day and night, though it was increased by warmth.

The mortality in the various stages from egg to adult is analysed. In one instance 57 per cent. of the pupae were destroyed by Tachinids and 3 per cent. by *Banchus femoralis*, Thoms. Meyer has suggested that more larvae survive in pole-woods as compared with stands of older trees owing to differences in the development of the May-shoots [xix, 698], but the author finds that these shoots develop uniformly in trees of from 21 to 120 years of age. The dangerous number of pupae appeared to be 1 per square metre, and the dangerous number of eggs from 300 to 3,500 per tree-crown in trees from 21 to 140 years old.

FRIEDERICHS (K.). **Witterung und Insekten in der Gegend von Rostock 1932.** [Weather and Insects in the District of Rostock in 1932.]—*Anz. Schädlingsk.*, ix, no. 3, pp. 29–34, 7 refs. Berlin, 15th March 1933.

This paper discusses the effect on the insect fauna of Rostock (Mecklenburg) of the unusual spring and summer weather in 1932, when long dry and warm periods were followed by rain in mid-summer without a fall in temperature. Infestation by sucking insects such as Aphids on beans and beet was slight, and the Aphid colonies on beet sometimes disappeared. Infestation by Aphids seems usually to be associated with dry weather, but this may be explained by the fact that they increase on plants the growth of which is checked, and in the present instance no such check occurred owing to the moist character of the soil. Though Aphids were not abundant there was a great increase in the numbers of their natural enemies, particularly Coccinellids. The author considers that meteorological factors are, usually indirectly, responsible for the initiation of an outbreak of a given insect, but that the outbreak can only develop in the local absence of factors of natural control.

HASE (A.). **Ueber die Dauerwirkung des Mottenschutzes durch Eulan. II. Teil. Ueber jahrelang bestehende Mottenechtheit von Wolle durch Imprägnierung mit "Eulan neu."** [On the lasting Effect of Eulan. Part ii. On the Retention for Years of the Moth-proof Quality of Wool impregnated with "Eulan neu."]—*Anz. Schädlingsk.*, ix, no. 3, pp. 35–39, 1 fig., 3 refs. Berlin, 15th March 1933.

This second part of a report on the effect of treatment of wool against the clothes moth, *Tineola biselliella*, Humn., with Eulan products [*cf. R.A.E.*, A, xx, 563] describes further experiments with the fabrics

impregnated with "Eulan neu" that were tested in 1929–30 by Beling [xix, 242] demonstrating the continued efficiency of the moth-proofing.

GÖRNITZ (K.). **Pathologische Veränderungen bei** *Vanessa io* **nach Aufnahme von Arsenverbindungen.** [Pathological Changes in *V. io* after Ingestion of Arsenical Compounds.]—*Anz. Schädligsk.*, ix, no. 3, pp. 40–41, 2 figs. Berlin, 15th March 1933.

Thirty last-instar larvae of *Vanessa io*, L., were fed on nettle leaves sprayed with calcium arsenate. In 13 days' feeding only 18 died, the remaining 12 pupating. The dead larvae and the pupae were deformed in various ways, and the 12 pupae produced only 2 adults. One of these died when emerging and the other was deformed.

LEMARIE (J.). **Neue Kontrollmethode des Nonnenvorkommens.** [A new Method for gauging the Occurrence of the Nun Moth.]—*Anz. Schädlingsk.*, ix, no. 3, pp. 43–44. Berlin, 15th March 1933.

For estimating the intensity of infestations by *Lymantria* (*Liparis*) *monacha*, L., in Czechoslovakia, Prof. Dyk has successfully used the attraction on the male moths of the scent of the females. In 1932 he obtained females for early liberation by exposing the pupae to heat. In forest tests 85 females were put out in 69 traps and 9,662 males were captured, many others having been eaten by bats near the cages. The females remained attractive for 3–14 days, with an average of 8, and the scent was not affected by mating, but ceased at oviposition.

KEMPER (H.). **Paradichlorbenzol als Schädlingsbekämpfungsmittel, besonders gegen Wohnungsinsekten.** [Paradichlorobenzene as an Insecticide, especially against Household Insects.]—*Z. Gesundh-Tech. u. Städtehyg.*, xxiv, no. 7–12, pp. 291–300, 5 refs. Dresden, 1932. [Recd. March 1933.]

The tests described were made by placing various insects in glass jars containing a layer of paradichlorobenzene crystals equivalent to 1 oz. per cubic foot, this being assumed to ensure saturation of the air by the fumes.

The following figures show the number of hours needed to kill the adults and, in brackets, the larvae if available: *Tineola bisselliella*, Humm., 3 (22), *Cimex lectularius*, L., 4 (4), *Tribolium confusum*, Duv., 5 (20), *Silvanus* (*Oryzaephilus*) *surinamensis*, L., 5, *Blatta* (*Periplaneta*) *orientalis*, L., 5 (5), *Tenebrio molitor*, L., 7 (34), *Periplaneta* (*Blatta*) *americana*, L., 7 (7), and *Calandra granaria*, L., 8. The larvae of *Attagenus pellio*, L., and *Anthrenus verbasci*, L., were killed by exposures of 26 and 32 hours respectively. The death of the Lepidopterous and Coleopterous larvae did not occur during exposure, but after an interval of several days, namely 4–10 for *Tineola*, 4–11 for *Tribolium*, 5–11 for *Attagenus*, 8–20 for *Anthrenus*, and 7–24 for *Tenebrio*. In the case of *Tineola* and *Attagenus* the younger larvae were more susceptible than the older ones, but no such difference was noticed with *Anthrenus*. Only old larvae of *Tenebrio* and *Tribolium* were available. The fumes had great penetrative power, very little longer exposure being necessary to kill insects in glass tubes plugged with cottonwool. The temperature during the above tests

was 19°C. [66·2°F.] ; when it was raised to 29°C. [84·2°F.], the times required were approximately halved. Paradichlorobenzene cannot be relied upon to destroy pests infesting fabrics if small bags containing it are hung among them in ordinary cupboards, but it may prevent their infestation if used in sufficient quantity and replaced when evaporated.

PEUS (F.). **Nutz- und Bauholz im Landbau, Schädlinge und Schutz.** [Timber and constructional Timber in Country Buildings, their Pests and Protection.]—*Z. GesundhTech. u. Städtehyg.*, xxv, no. 1, pp. 41–50. Berlin, January 1933.

Notes are given on the insects that cause injury to worked timber in Germany. Besides the usual Coleoptera and Siricids, they include two ants, *Camponotus herculeanus*, L., and *Lasius fuliginosus*, Latr., which make their nests in the timber. The former is especially likely to occur in houses in or near forests. The latter is capable of attacking panelling and even furniture.

PEUS (F.). **Ameisenbekämpfung in und an Wohnungen, Krankenhäusern, Wasserwerken und Friedhöfen.** [Measures against Ants infesting Dwellings, Hospitals, Waterworks, and Cemeteries.]—*Z. GesundhTech. u. Städtehyg.*, xxv, no. 1, pp. 63–67, 2 figs., 1 ref. Berlin, January 1933.

This circular, which is the first of a series on communal vermin destruction, gives a brief account of the classification and bionomics of the ants found in Germany and of the use of baits and fumigants against them.

PARKER (H. L.) & SMITH (H. D.). *Eulophus viridulus* **Thoms., a Parasite of** *Pyrausta nubilalis* **Hübn.**—*Ann. Ent. Soc. Amer.*, xxvi, no. 1, pp. 21–39, 15 figs., 13 refs. Columbus, Ohio, March 1933.

An account is given of investigations in Italy on *Eulophus viridulus*, Thoms., which occurs in small numbers as a parasite of *Pyrausta nubilalis*, Hb., in maize, hemp and *Artemisia* in central Europe and northern and southern France, and in the lower Po Valley and near Naples, being rather abundant in one locality in the Province of Rovigo. Its identity is discussed, and all stages and the process of emergence and pairing are described. The eggs are laid more or less indiscriminately on the paralysed larvae of the last three instars (to which they are not attached in any way) usually in the tops of the hemp stalks. Paralysis of the host does not appear necessary for the development of the parasite. The larvae feed externally for 4–5 days and pupate on or near the remains of the host within its tunnel. The adults are comparatively strong fliers and are attracted to light ; the females predominate over the males in the ratio of 2 : 1. It appears that the life-cycle from egg to adult occupies about 14 days in July and August. Hibernation occurs in the pupal stage and appears to be a true diapause. At least three generations are probable in the lower Po Valley, the first two occurring in hemp and an early maturing variety of maize on the first brood of *P. nubilalis*, the larvae of which are generally present from early July to the middle of August, and the third and probably a partial fourth in the same and a later variety of maize on the second brood, the larvae of which occur from 15th

August to the following May, most of them maturing about 15th September. In the summer the number of individuals on a host averages 7·6 and in the autumn and winter 16·5 and 23·3 respectively. The mite, *Pediculoides ventricosus*, Newp., was attached near the anal extremity of four pupae in one colony.

Efforts to breed *E. viridulus* on a large scale have so far proved unsuccessful. Field collection during the winter yielded a total of 328,026 pupae for shipment to the United States. In general, this species is of little economic value in Europe, but in the one locality in which it was comparatively abundant, it killed 4 per cent. of the total population and in four fields was found to be present in numbers of 9,976, 11,620, 21,631 and 26,160 individuals per hectare [2·47 acres].

Trapping *Ceratitis.*—*Cyprus Agric. J.*, xxviii, pt. 1, pp. 17–20. Nicosia, March 1933.

In experiments in Cyprus in the trapping of *Ceratitis capitata*, Wied., pans containing poison bait proved less satisfactory than a spherical glass trap with hollow conical base, baited with bran and borax (8 oz. of each to 1 gal. water) or with Clensel (1 to 20–40 parts water) [*R.A.E.*, A, xix, 141, 276, 647]. The bran and borax bait was perhaps slightly more attractive, but the Clensel remained attractive longer. At the end of July 1932, 16 traps hung in mulberry and fig trees captured a total of 2,596 flies in 3 days and a further 3,866 between 2nd August and 17th December. About 77 per cent. were females. Traps should be maintained throughout the year and moved as the different fruits become nearly ripe. In the colder months they should be hung in sunny parts of the trees, in hot months in partial shade.

Cunin (G.). **Trois genres de Noctuidae nuisibles aux cultures de pommes de terre sur les Hauts-Plateaux Constantinois.**—*Bull. Soc. Hist. nat. Afr. N.*, xxiv, no. 2, pp. 34–42, 2 diagr., 1 map. Algiers, February 1933.

Potatoes in the highlands of eastern Algeria are attacked by several Noctuids, especially *Laphygma* (*Caradrina*) *exigua*, Hb., and, in some localities, *Phytometra* (*Plusia*) *gamma*, L., and *Agrotis* sp. In 1931 three generations of *Laphygma* and *Phytometra* were observed on potatoes and two of *Agrotis* ; in 1932, a relatively cold year, there were two of *Laphygma* and *Phytometra* and one of *Agrotis*. The larvae of all three species appear about the beginning of July, some 3 weeks after the potatoes are planted. Those of *L. exigua* feed at night on the parenchyma of the leaves. After 10 days they go into the soil to pupate, and the adults emerge in 8–10 days. The eggs are laid in the soil a few days later and hatch within a week. Plants attacked by the first brood are less resistant to the second, which is the most harmful. The larvae of *P. gamma* have similar feeding habits, but the eggs are laid on the lower surface of the leaves. The larval and pupal stages total 20–25 days, and incubation lasts 10–12. The eggs of *Agrotis* are laid in the soil, and the larvae attack the stems at the level of the ground. The egg and larval stages each last 10–15 days, and the pupal stage 2–3 weeks. The second generation larvae are less able to damage the stems, but they also attack the young tubers near the surface of the soil.

Flooding the soil to destroy the eggs (except of *Phytometra*), larvae and pupae has sometimes given good results. Arsenical sprays can

be used against *Laphygma* and *Phytometra*, and poison baits against *Agrotis*.

HARGREAVES (H.). **Annual Report of the Government Entomologist.**—*Ann. Rep. Dept. Agric. Uganda 1931*, pt. ii, pp. 43–47. Entebbe, 1932. [Recd. April 1933.]

The extensive invasion and breeding of *Locusta migratoria migratorioides*, Rch. & Frm. [*cf. R.A.E.*, A, xx, 70, 499] in Uganda in 1931 are discussed, and a list is given of the plants attacked, chiefly gramin-aceae, but including *Cyperus* sp., bananas and *Phoenix reclinata*. Other plants were nibbled by hoppers, apparently in search of moisture rather than food. Non-graminaceous crops, planted in expectation of locust attack, helped to compensate for loss of grain.

Platyedra gossypiella, Saund. (pink bollworm) appeared for the first time in Uganda, in the Gulu district, having apparently penetrated from the Sudan. It is not yet known whether it has a resting larval stage in Uganda or an alternative food-plant. Damage done by it to cotton was not distinguished in the field from that caused by *Argyroploce leucotreta*, Meyr., with which it was associated. Other prevalent pests on cotton included the Capsid, *Lygus vosseleri*, Popp., which also fed on *Vigna catjang*, the Jassid, *Empoasca facialis*, Jac., which attacked some varieties more severely than others and was probably more injurious under dry conditions, and an Aleurodid, which was parasitised by the Aphelinid, *Eretmocerus diversiciliatus*, Silv. In some localities the crop was almost destroyed by *Helopeltis*. *Geocoris amabilis*, Stål, believed to feed on cotton, was proved to be a predator.

Pests of sim-sim [*Sesamum*] included the Pentatomids, *Aspavia* (*Carbula*) *armigera*, F., *Acrosternum* sp., *Veterna patula*, Dist., *Nezara viridula*, L., and *Agonoscelis versicolor*, F., the Pyralid, *Antigastra catalaunalis*, Dup., and the Cecidomyiid, *Asphondylia sesami*, Felt. The first crop (June–August) was much more severely infested than the second (October–December), so that serious damage might possibly be avoided by planting during the later rains. The indigenous *Sesamum angustifolium* is an alternative food-plant of *A. sesami* and *Antigastra catalaunalis*. Sweet potato in some districts was severely damaged by the Sphingid, *Herse convolvuli*, L., and maize by *Busseola fusca*, Fuller, and *Argyroploce leucotreta* and to a less extent by *Parnara borbonica*, Boisd., and *Marasmia trapezalis*, Gn. The egg, larval, pupal and pre-oviposition periods of *B. fusca* lasted 10, 68–74, 14–16 and 3–5 days respectively. A maximum of 249 eggs was laid in 5 days. *Pennisetum* was found to be a wild food-plant. Both *B. fusca* and *A. leucotreta* were relatively scarce on the October–December crop.

Coffee was attacked by the Tingid, *Habrochila placida*, Horv., and by a species of *Metadrepana* (distinguished from *M. marantica*, Tams [xviii, 426] by its eggs being laid singly), the larvae of which are destroyed by the predatory wasp, *Eumenes maxillosus*, DeG. (*tinctor*, Christ).

NOTLEY (F. B.). **The Control of *Antestia* in wetter Districts. Notes on a Paraffin-Pyrethrum-Soap Emulsion Spray.**—*Bull. Dept. Agric. Kenya*, no. 4 of 1933, 12 pp., 8 refs. Nairobi, 1933. Price Cts. 50.

The author criticises the various methods in use for the control of *Antestia* on coffee [*cf. R.A.E.*, A, xvii, 626 ; xix, 572 ; xx, 117, 546].

He finds smoking [xiii, 352] ineffective and bait-sprays, especially in rainy districts, unreliable. Recently a kerosene-pyrethrum spray has been recommended [xxi, 265, etc.]. Good results were obtained against *A. faceta*, Germ., by spraying with a diluted emulsion composed of 5 gals. of this mixture (1 lb. pyrethrum powder in 1 gal. kerosene) and ½ lb. household soap in 1 gal. water. This emulsion at a concentration of 1 : 50 gave 100 per cent. control in the laboratory and killed over 90 per cent. of the bugs under average field conditions. Even at a low concentration (1 : 150), the spray made the bugs drop to the ground in a state of coma, from which however they generally recovered. It is suggested that a low-concentration spray, followed by hand collection of the fallen bugs, would be much cheaper than a more concentrated one and might be equally effective provided that the ground is perfectly clear of weeds. In any case it is advisable to prune before spraying and burn the prunings. On being hit by the spray, the bugs tended to run up the tree, so that an extra spraying should always be given to the top. The emulsion, besides being more economical than pure kerosene, is less likely to scorch foliage. The effect of increasing the proportion of pyrethrum to kerosene in it has not yet been tried.

A South American Weevil infesting Lucerne in New South Wales.—May 1933.

The Imperial Institute of Entomology has just received from the Government Entomologist of New South Wales specimens of a weevil the larvae of which have been found attacking roots of lucerne in that country. The insect proves to be a South American species, *Naupactus leucoloma*, Boh., which was originally described from Tucumán, N.W. Argentina, but has been recorded from Chile and Uruguay. As it may also have been transported elsewhere and may develop into a pest, its further occurrence should be noted.

MacDougall (R. S.). **Insect Pests No. xviii.**—*Scot. J. Agric.*, xvi, no. 2, pp. 208–218, 4 refs. Edinburgh, April 1933.

This paper, the last of a series on insect pests in Britain [*R.A.E.*, A, xxi, 139, etc.], deals with the preparation and uses of insecticides.

Mesnil (L.). **Sur deux Chloropides considérés à tort comme nuisibles.**—*Rev. Path. vég. Ent. agric.*, xx, no. 1, pp. 3–7, 1 pl., 9 refs. Paris, January 1933.

The larvae of the Chloropids, *Chloropisca glabra*, Mg. (*assimilis*, Macq.) and *C. notata*, Mg. (*circumdata*, Mg.), wrongly believed to eat the roots of cereals, sugar-beet and other plants [*R.A.E.*, A, xii, 129; xviii, 53], have been found from observations in France to feed on root-infesting Aphids [*cf.* xix, 629].

André (M.). **Sur la biologie des Tétranyques tisserands.**—*Rev. Path. vég. Ent. agric.*, xx, no. 1, pp. 8–25. Paris, January 1933.

This is a review, based largely on the literature, of the bionomics of Tetranychid mites, with notes on the damage to plants caused by different species in various parts of the world.

Benlloch (M.). **La " pulguilla " de la remolacha.** [The Halticid of Beet.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 69–74, 2 figs., 5 refs. Madrid, 1932. [Recd. April 1933.]

In Spain, *Haltica oleracea*, L., is commonly regarded as the chief Halticid that attacks the leaves of beet, but *Chaetocnema tibialis*, Ill., is actually the most injurious species. It hibernates in the adult stage, but very little is known about oviposition or the plants on which the larvae live, the adults alone having been observed on beet, their favourite food-plant. Excellent results were obtained in experiments with a calcium arsenate dust containing 14 per cent. As_2O_5 and a dust containing 3 per cent. nicotine. Dusting is preferable to spraying. A method that merits further investigation is that of passing a stone roller over the field immediately the young plants appear [*R.A.E.*, A, xix, 278].

Gómez Clemente (F.). **Un ensayo de lucha biológica contra la** *Ceratitis capitata* **en Valencia.** [An Attempt in the biological Control of *C. capitata* in Valencia.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 80–89, 7 figs., 10 refs. Madrid, 1932. [Recd. April 1933.]

Work on the biological control of fruit-flies in various parts of the world during the past 30 years is reviewed. For controlling *Ceratitis capitata*, Wied., in Valencia a batch of 1,200 adult Braconids, including *Opius humilis*, Silv., *Diachasma tryoni*, Cam., and *D. fullawayi*, Silv., were despatched in May 1931 from Hawaii to Spain *via* the United States. Of these, 110 *O. humilis* and 27 *D. tryoni* reached Valencia in June and were placed in insectaries with peaches infested by the fly. *D. tryoni* failed to reproduce, but *O. humilis* had a first generation of 26 individuals that in turn produced 5 males and 1 female. Owing to hot weather, these died before the female had oviposited. Because of the American regulations, only adults could be brought *via* the United States, and the long journey is regarded as the reason for the failure of this attempt.

Nonell Comas (J.). *Aphelinus mali* **y su difusión en España.** [*A. mali* and its Distribution in Spain.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 90–97, 8 figs., 11 refs. Madrid, 1932. [Recd. April 1933.]

An account is given of the distribution in Spain of *Aphelinus mali*, Hald., imported from Uruguay and Italy in 1926 against *Eriosoma lanigerum*, Hausm., on apple [*R.A.E.*, A, xiv, 616]. It is now established over a wide area, particularly in the north, and has proved of considerable value.

Benlloch (M.). **Un esfíngido perjudicial a la vid** (*Celerio lineata*, **F., var.** *livornica*, **Esp.** [A Sphingid harmful to Grape-vines.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 110–114, 2 figs., 9 refs. Madrid, 1932. [Recd. April 1933.]

In 1928 and 1931 outbreaks of *Celerio lineata* var. *livornica*, Esp., which is believed to migrate from North Africa, occurred in vineyards in many parts of Spain. The adult and larva are described, and various food-plants are recorded from the literature. Only one generation

was observed, but it is possible that a second occurs further northwards, as a result of renewed migration. The larvae appeared in June and pupated near the surface of the ground, the pupal stage lasting 8–10 days. They feed at first on wild plants, and when these become scarce owing to the summer drought, they pass to vines. In 1928 in Huelva severe injury to the latter was followed by migration to cotton. Control may be effected by a spray of lead arsenate (1 lb. to 10 gals.), and Bordeaux mixture repels the larvae, but in any case the attack lasts only a few days and is not repeated in the same year.

HERCE (P.). **Absorción de cianhídrico por las castañas.** [Absorption of HCN by Chestnuts.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 115–122. Madrid, 1932. [Recd. April 1933.]

Chestnuts for export from Spain are commonly fumigated with hydrocyanic acid gas at the rate of 145 oz. HCN per 1,000 cu. ft. In an experiment 100 chestnuts fumigated for 24 hours at this concentration absorbed 108 mgm. of HCN [*cf. R.A.E.*, A, xvi, 471]. Airing for 24 hours reduced the amount to 69·5 mgm., and no trace of HCN was perceptible after airing for 3 days. The fatal dose for man is usually considered to be 50–70 mgm.

GÓMEZ CLEMENTE (F.). **La mosca de las frutas.** [The Fruit-fly.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 133–144, 9 figs. Madrid, 1932. [Recd. April 1933.]

This is an account of the bionomics and control of *Ceratitis capitata*, Wied., with particular reference to Spain [*R.A.E.*, A, xv, 315 ; xix, 276, etc.].

BERRO AGUILERA (J.). **La polilla de la patata.** [The Potato Tuber Moth.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 145–152, 6 figs. Madrid, 1932. [Recd. April 1933.]

In view of the occurrence of *Phthorimaea operculella*, Zell., in 1931 in potato stores in Almeria, an account is given of its biology and control [*cf. R.A.E.*, A, xiv, 181].

Trabajos de las Estaciones de Fitopatología agrícola en el año 1931. [Work of the Stations of agricultural Phytopathology in Spain in 1931.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 171–218. Madrid, 1932. [Recd. April 1933.]

As in previous years [*R.A.E.*, A, xx, 251, etc.], brief notes are given on the pests and diseases recorded by the various phytopathological stations.

CURZI (M.). **I tripidi come causa della " malattia del pennacchio " del pesco.** [Thrips as the Cause of Peach " Plume Disease."]—*Bol. R. Staz. Pat. veg.* [*Rome*], xii, no. 2, pp. 238–243, 2 figs. Rome, 1932.

Early Elberta peaches in central Italy and Tuscany suffer from a condition known as " plume disease." The author found that larvae

and adults of a species of thrips were always present on the affected trees and concludes that the symptoms are produced by the lesions they cause in feeding and are not due to a virus.

de Fluiter (H. J.). **Bijdrage tot de kennis der oecologie en morphologie van *Eriosoma lanuginosum* (Hartig), de "bloedluis" onzer pereboomen.** [A Contribution to the Knowledge of the Ecology and Morphology of *E. lanuginosum*, the "Woolly Aphis" of Pear Trees in Holland.]—*Tijdschr. PlZiekt.*, xxxix, no. 3, pp. 45–72, 3 pls., 38 refs. Wageningen, March 1933.

In Holland, six woolly Aphids produce typical leaf-galls on elm, their winter food-plant, *viz.*, *Eriosoma patchae*, Börner & Blunck, the summer food-plant of which is unknown, *E. lanuginosum*, Htg., which occurs on pear, *E. ulmi*, L., on *Ribes*, *Colopha compressa*, Koch, on *Carex*, *Gobaishia pallida*, Hal., on *Mentha*, and *Tetraneura ulmifoliae*, Bak. (*Byrsocrypta gallarum*, Gmel.), on grasses. The last four attack the roots of their summer food-plants.

A survey of the literature dealing with the migration of *E. lanuginosum* is given. In 1932 the Aphids were found on the trunks of pear trees at heights of 1½–13 ft. above ground on old wounds and between cracks in rough bark, but could not be discovered on the roots. It is probable that owing to the damp climate this species normally occurs above ground in Holland. There appear to be 2–3 generations on pear. On 8th September the first alate individuals (autumn migrants or sexuparae) were noticed. All the colonies developed these sexuparae, which fly to elm, and in November the pear trees were entirely free from infestation. On 27th September and 6th and 8th October numerous winged individuals were observed settling on the leaves and twigs of elms and moving downward to the rough trunks where they disappeared in cracks in the bark. These migrants included not only *E. lanuginosum* but also *E. ulmi*, *T. ulmifoliae*, and others that were possibly *E. patchae*. In the laboratory a fair number of sexuales were produced by the sexuparae and developed fully in about a week, both sexes moulting 4 times. The differences between them and the sexuales of the apple aphis, *E. lanigerum*, Hausm., are given. The female deposits one egg ½–1½ days after pairing. In nature the egg is laid on the bark of the elm and in spring the fundatrix larva hatches and forms galls on the leaves.

The morphology of the adult virginogeniae, nymphs, sexuparae, and adult sexuales is described. A comparison of specimens of *E. lanuginosum* and the American *E. pyricola*, Baker & Davidson, showed them to be distinct; the distinguishing characters are indicated.

Thomsen (M.) & Wichmand (H.). **Ueber die Giftrindenmethode und andere Bekämpfungsmassnahmen gegen *Hylobius abietis*.** [On the use of poisoned Bark and other Measures against *H. abietis*.]—*Z. PflKrankh.*, xliii, no. 4, pp. 145–167, 4 figs. Stuttgart, 1933.

Outbreaks of the pine weevil, *Hylobius abietis*, L., are due chiefly to clear felling, and natural restocking is the first and most important control measure. In Denmark it has been observed that young plants shaded by old conifers are not severely infested. If there are no old

conifers, a preliminary planting of birch, alder, etc., will prove cheaper than direct measures against the weevil. The latter will, however, be necessary for many years until the new methods become effective. Experiments on the use of poisoned trap-bark were made on an island in the Cattegat. Of the poisons tested in the laboratory, derris powder and a 20 per cent. solution of potassium carbonate proved useless; sodium fluosilicate was too slow in action; mercury bichloride (1 per cent. solution) was uncertain; and sodium fluoride dust acted quickly but fell off the bark in fleecy lumps so that it was unsuitable for dusting. The best results were obtained with arsenical compounds, and arsenic trioxide, potassium arsenate, lead arsenate, and calcium arsenate were therefore tried in the field. Lead arsenate and calcium arsenate gave consistently satisfactory results, the latter being preferable. The dust should be blown in a thin layer on to the inner, sticky surface of pieces of bark. The weevils eat the poisoned bark as readily as untreated trap-bark, and die within a few days.

Borchert [A.]. **Die Milbenseuche der Honigbiene.** [The Acarine Disease of the Honey-bee.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 125, 4 pp., 4 figs. Berlin, March 1933.

Infestation of bees by *Acarapis woodi*, Rennie, is unknown in Germany except for a few cases in Saxony and Bavaria. A description is given of the mite, with a note on its harmless external form [*R.A.E.*, A, xx, 237], and an account of the symptoms it causes and its control with Frow's mixture [xx, 63, 144].

Moeller (—). **Bekämpft den Getreidelaufkäfer!** [Control the Cereal Ground-beetle!]—*Ratschläge f. Haus, Garten, Feld*, vii, 1932, pp. 177–179, 1 fig. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 2, pp. 37–38. Vienna, April 1933.)

In the course of the last few years the Carabid, *Zabrus tenebrioides*, Gze., has been causing considerable damage to cereals in Saxony [*cf.* *R.A.E.*, A, xx, 486]. The larvae live three years and sometimes migrate to uninfested fields. Migration has been effectively prevented by leaving a fallow strip about 20 ins. wide round the field, separating it from a further strip of the same width, on which a trap crop is sown. As soon as the latter begins to sprout, it is dusted with an arsenical so that the migrating larvae are killed on it.

R. W. **Kirschblütenmotte und Kirschfliege.** [The Cherry Blossom Moth and Cherry Fly.]—*Schweiz. Z. Obst- u. Weinb.*, 1932, no. 13, p. 262. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 2, p. 38. Vienna, April 1933.)

During the severe outbreak of *Rhagoletis cerasi*, L., in eastern Switzerland in 1931, larvae of *Argyresthia ephippiella*, F., occurring in the flowers of cherries, were often mistaken for those of the fly. An account is given of the bionomics of both pests and the character of the damage they cause. As the percentage of blossoms destroyed by *Argyresthia* varied between 50 and 83 in 1931, attention should be devoted to its control [*cf.* *R.A.E.*, A, xvi, 612].

SCHIMITSCHEK (E.). **Forstentomologische und forstschutzliche Untersuchungen aus dem Gebiete von Lunz. II. Der Nordhang, Bestand und Kahlfläche. Verhältnisse an verschiedenen exponierten Bestandesrändern.** [Investigations in Forest Entomology and Forest Protection in the Lunz District. II. The northern Slope, Stands and felled Areas. Conditions on the exposed Edges of Stands.]—*Zbl. ges. Forstw.*, lviii, pp. 225–267, 2 figs., 3 pls. Vienna, 1932. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 2, pp. 38–39. Vienna, April 1933.)

Further investigations in the district of Lunz, Austria [*R.A.E.*, A, xx, 48], showed that *Ips* (*Pityogenes*) *chalcographus*, L., sometimes occurs alone in standing or fallen spruce and sometimes in association with *I. typographus*, L., though it prefers a lower temperature than the latter. The adults are most active at 20–26°C. [68–78·8°F.] and cease to fly at temperatures below 15°C. [59°F.]. In the waste wood in a clear felled area the development of *I. chalcographus* was completed by mid-July, when new flight and oviposition started. The beetles heavily infested a trap tree in the felled area, whereas a similar tree in the stand was only slightly attacked, though the infestation increased later. This was due to the fact that in a stand the cambium in the tree decomposes more slowly owing to the lack of direct insolation and a lower temperature ; moreover the excess of humidity in the tree kills the eggs and young larvae.

The Lamiids, *Monochamus sartor*, F., and *M. sutor*, L., attacked the trap tree in the felled area, preferring the parts of the trunk that had a lower temperature. The peak of their flight was reached in mid-August ; the egg stage lasted 16 days, and the development of a generation in the felled area was completed in 18 months. The beetles were parasitised by three species of *Rhyssa*.

NEUBAUER (E.). **Ein neuer Obstbaumschädling in der Altmark.** [A new Pest of Fruit Trees in Altmark.]—*Ratschläge f. Haus, Garten, Feld*, Ausg. B, vii, 1932, pp. 102–103, 1 fig. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 2, p. 40. Vienna, April 1933.)

Injury to fruit trees in certain districts of central Germany is caused by adults of the Galerucid, *Luperus pinicola*, Andersch, which are very active, destroying the leaves and immature fruits of pears, apples and cherries and also attacking cabbages. Eggs are laid in batches of 40–70 under grasses, on the roots of which the larvae feed, often killing the plants. Control might be effected by applying an arsenical spray as soon as the beetles appear.

MÜLLERS (L.). **Die weissfüssige Kirschblattwespe als Erdbeerschädling.** [The White-legged Cherry Sawfly as a Pest of Strawberries.]—*Ratschläge f. Haus, Garten, Feld*, Ausg. B, vii, 1932, pp. 67–69, 1 fig. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 2, p. 40. Vienna, April 1933.)

Near Düsseldorf (western Germany) the sawfly, *Priophorus padi*, L., migrates from stone-fruits and rose bushes to strawberry plants, eggs being laid in chains on the lower surface of the leaves. The larvae, which are described, at first feed on the leaves from below and then pass to the upper surface, eating out holes and only leaving the veins.

Pupation occurs in cocoons on or just below the surface of the soil. There are three generations a year, activity continuing from April to October.

FLACHS (K.). **Milbenkrankheit an Mais.** [A Mite Disease of Maize.]—*Prakt. Bl. PflBau u. PflSch.*, xi, no. 1–2, pp. 52–54, 3 figs. Freising, 1933.

Abnormalities in the cobs, involving a reduction in the grains and sometimes complete infertility, observed in certain maize plants in Bavaria, were apparently due to mites, probably *Pediculopsis graminum*, Reut., which were numerous in the leaf-sheaths or on the leaves enclosing the cobs. *P. graminum* causes white-ear in grasses, but the author does not know of any record of injury to maize.

STADLER (H.). **Ein neuer Ichneumonide aus Schwammspinnerraupen** (*Lymantria dispar* **L.**). [A new Ichneumonid from *Porthetria dispar.*]—*Ent. Anz.*, xiii, nos. 2–4, pp. 27–30, 43–45, 58–60, 1 fig., 1 ref. Vienna, 1933.

A list is given of the known natural enemies of *Porthetria* (*Lymantria*) *dispar*, L., with notes on a species of the genus *Anilastus* obtained from two larvae of the moth in Germany and believed to be new. A hyperparasite, *Hemiteles areator*, Panz., emerged from one of the cocoons of *Anilastus*.

LINDINGER (L.). **Eine für Deutschland neue Schildlaus,** *Lepidosaphes conchiformis*. [A Coccid new to Germany.]—*Z. PflKrankh.*, xliii, no. 4, pp. 167–169. Stuttgart, 1933.

The author states that examination shows *Lepidosaphes rubri*, Thiem [*R.A.E.*, A, xx, 577] to be a synonym of *L. ficus*, Sign., for which he considers *L. conchiformis*, Gmel., to be the correct name.

KARPIŃSKI (J. J.). **Fauna korników puszczy Białowieskiej na tle występujących w puszczy typów drzewostanów.** [The Fauna of Bark-beetles in the Virgin Forest of Bialowies based on the Types of Vegetation Zones occurring there.] [*In Polish.*]—*Trav. Inst. Rech. For. État Varsovie*, Ser. A, no. 1, 68 pp., 2 figs., 11 pls., 8 charts, 11 refs. Warsaw, 1933. (With a Summary in French.)

This paper presents the results of two years' investigations in the forest of Bialowies in north-eastern Poland on the relation existing between the various types of stands and the associations of bark-beetles occurring in them. A section of 23 pages, which contains notes on a large number of Scolytids, has already been noticed from a somewhat shorter version [*R.A.E.*, A, xix, 406]. The part that insects play in upsetting the natural balance in a forest community is discussed, and the importance of knowing those that are invariably associated with certain vegetational zones is pointed out. The character of the vegetation in the forest of Bialowies is described, and a detailed account is given of the different associations of beetles observed in the various types of stands, which form seven distinct zones. A certain regularity exists in the occurrence of Scolytids, which renders possible the determination of the type of stand by the presence of certain species in individual trees.

Zolk (K.). **Die Borkenkäfer (Ipidae) Estlands mit kurzer Berücksichtigung ihrer Bionomie u. Verbreitung.** [The Bark-beetles of Estonia, with a brief Survey of their Bionomics and Distribution.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 14, 52 pp., 1 map, 13 pls., 55 refs. Tartu [Dorpat], 1932. (With a Summary in German.) [Recd. April 1933.]

This paper deals with 48 Scolytids, notes being given on their distribution and frequency of occurrence, the trees they attack and, in many instances, their economic importance and biology, with a list of the bark-beetles recorded from areas adjoining Estonia, which include 35 additional species.

Määr (A.). **Fliedermotte**—*Gracilaria* (*Xanthospilapteryx*) *syringella* **F. Biologische Beobachtungen in Eesti im J. 1931.** [The Lilac Moth, *G. syringella*. Biological Observations in Estonia in the Year 1931.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 15, 19 pp., 1 fig., 1 graph., 4 pls., 23 refs. Tartu [Dorpat], 1932. (With a Summary in German.) [Recd. April 1933.]

The following is taken from the author's summary, some of the observations being similar to those already noticed [*R.A.E.*, A, xvii, 325] : *Gracilaria syringella*, F. (lilac leaf-miner) is very common in Estonia, having been observed on privet (*Ligustrum vulgare*) and various species of lilac (*Syringa*) and ash (*Fraxinus*), a list of which is given, showing the degree of preference for each. In 1931, larvae of the first generation were present from late May till mid-August, and those of the second from late July till about mid-October, when pupation took place. Larvae that have not pupated are usually killed by the first night frosts. Development of the first generation from egg to adult was completed in an average of 8–9 weeks ; in August the larvae reached maturity in 12 days, and in September in 24. The number of eggs on each leaf varied from 5 to 37.

Zolk (K.). **Das Vorkommen der Rübenfliege** (*Pegomyia hyoscyami* **Panz.**) **in Estland und einiges über ihre Bionomie.** [The Occurrence of the Beet-fly, *P. hyoscyami*, in Estonia and a few Notes on its Bionomics.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 16, 11 pp., 1 map, 1 graph, 5 figs., 6 refs. Tartu [Dorpat], 1932. (With a Summary in German.) [Recd. April 1933.]

The following is taken from the author's summary : An outbreak of *Pegomyia hyoscyami*, Panz. (beet-fly), which became established in Estonia about 15 years ago, following the increased cultivation of beet there, occurred in 1929, the summer of 1928 having been particularly cold and rainy. The adults appear in mid-May and oviposit 4–6 days later, 1–18 eggs being usually laid on the lower surface of the cotyledons or leaves. Under experimental conditions one female laid a total of 112 eggs. The larvae hatch in 4–10 days and reach maturity in 9, pupating at a depth of 2–3½ ins. in the soil. The adults emerge after 23–24 days. There are usually two generations a year, though under favourable weather conditions a third may occur. The larvae of this generation, however, usually fail to mature before the beet is harvested at the beginning of October. This may account for the fact that the fly is not a serious pest annually in Estonia.

ZOLK (K.). **Die wichtigsten Pflanzenschädlinge auf den Inseln Saaremaa and Muhu.** [The chief Pests of Vegetation on the Islands of Oesel and Mohn]. [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 19, 8 pp., 1 map. Tartu [Dorpat], 1932. (With a Summary in German.) [Recd. April 1933.]

Notes are given on a number of insects injurious to cultivated plants in the Estonian islands of Oesel and Mohn, of which the following are the most important: *Sitona lineata*, L., and *S. crinita*, Hbst., on peas; *Euxoa* (*Agrotis*) *segetum*, Schiff., on potatoes and winter sown rye; *Aphis* (*Amphorophora*) *avenae*, F., on cereals; *Hyponomeuta malinellus*, Zell., on fruit trees; and *Trioza viridula*, Zett., on carrots. Eighteen species of forest pests are also enumerated.

ZOLK (K.). **Einiges über die Tätigkeit der Versuchsstation für angew. Entomologie d. Universität Tartu 1921–1932.** [A few Notes on the Activities of the Experiment Station for applied Entomology of the Tartu [Dorpat] University in the Years 1921–32.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 21, 10 pp., 1 map. Tartu [Dorpat], 1932. (With a Summary in German.) [Recd. April 1933.]

The following is taken from the author's summary: In the course of the work of this station in Estonia during 1921–32, a survey of which is given, an outbreak of the Ephydrid, *Hydrellia griseola*, Fall., was to a great extent checked by the application of a top dressing of sodium nitrate, which also proved effective against the beet-fly, *Pegomyia hyoscyami*, Panz. *Phytometra* (*Plusia*) *gamma*, L., on flax was successfully controlled by the destruction of the pupae after the harvesting of the crop. Spraying twice with oil emulsion proved very effective against the Psyllid, *Trioza viridula*, Zett., and good results were obtained with arsenical dusts against *Phaedon cochleariae*, F., on turnip. It was found that 20–100 per cent. of winter crops sown on weedy fallow were damaged by *Euxoa* (*Agrotis*) *segetum*, Schiff., in 1927 [*R.A.E.*, A, xix, 700], whereas those grown on clean fallow escaped infestation. The Elaterid, *Agriotes obscurus*, L., was observed to be parasitised by the Proctotrupid, *Paracodrus apterogynus*, Hal., which has not previously been recorded from Estonia as a parasite of this host [*cf.* xii, 434; xiii, 68]. Against the sawfly, *Athalia colibri*, Christ (*spinarum*, F.), dusting with a mixture of calcium arsenate and sodium fluosilicate proved effective. Arsenical dusts with the addition of 1–2 per cent. sodium fluosilicate also gave satisfactory results against *Cassida nebulosa*, L., flea-beetles and *Sitona* spp. in cold weather. The use of calcium arsenate has considerably reduced the abundance of *Pteronus* (*Pteronidea*) *ribesii*, Scop., on gooseberry and currant bushes.

ZOLK (K.). **Der Erdbeerenlaufkäfer** (*Harpalus pubescens* **Müll.**) **und seine Bekämpfung.** [The Strawberry Ground-beetle, *Ophonus pubescens* and its Control.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 22, 10 pp., 3 figs. Tartu [Dorpat], 1932. (With a Summary in German.) [Recd. April 1933.]

The following is taken from the author's summary: Considerable damage to strawberries in Estonia is caused by the Carabid, *Ophonus* (*Harpalus*) *pubescens*, Müll., 75–95 per cent. of the crop being sometimes

destroyed. The adults, which, as well as the larvae, usually feed on other insects, slugs, etc., remove and devour the seeds of maturing berries, in which they sometimes make deep holes. In 1932 the oviposition period lasted from 12th July to 11th August. The eggs, of which a female lays about 20, are deposited in the soil at a depth of about 2 cm. The larvae hatch in two weeks and pupate in the following year in the soil. The adults emerge in the summer and autumn, and hibernate ; thus the development of a generation is completed in two years.

In an experiment, phosphorus and sugar mixed with size to a paste proved an effective bait, killing all the beetles within 48 hours of its application ; in another test, in which planks coated with the paste were placed on the ground with the treated side turned to the soil, the beetles died in 24 hours. Baits poisoned with Urania green, sodium arsenate or calcium arsenate only killed 10–25 per cent. of the beetles.

ZOLK (K.). **Schädlingskalamität in Estland im Herbste d. J. 1932.** [An Insect Outbreak in Estonia in the Autumn of the Year 1932.] [*In Estonian.*]—*Mitt. Versuchssta. angew. Ent. Univ. Tartu*, no. 23, 6 pp., 2 figs., 1 ref. Tartu [Dorpat], 1933. (With a Summary in German.)

The following is taken from the author's summary : In the autumn of 1932 an outbreak of the Rutelid, *Phyllopertha horticola*, L., occurred on winter sown crops over an area of 1,235 acres in north-eastern Estonia, larvae of the Melolonthids, *Amphimallus solstitialis*, L., and *Melolontha hippocastani*, F., being also present. The main flight of the adults of *Phyllopertha* occurs in mid-June, isolated beetles being on the wing as late as August. Since they readily oviposit in clover fields and meadows, winter crops should not be sown on clover fallow in years when an outbreak may be expected. Repeated tilling of the fallow will bring the larvae to the surface and destroy their food-plants. Bushes that grow near the fields should be dusted with calcium arsenate when the beetles are in flight.

[REKK (G. F.).] **Рекк (Г. Ф.). Methods of chemical Control of certain Root Pests of Fruit Trees. (Preliminary Information.) The Black Flat-headed Borer. The Pear Root Aphis.** [*In Russian.*]—*Bull. Pomol. Expt. Sta. People's Commiss. Agric. SSR Georgia*, Div. Plant Prot., no. 1, iv+48 pp., 8 figs., 27 refs. Tiflis, Gosizd. Gruzii [St. Pub. Georgia], 1932. Price 60 *kop.* (With a Summary in English.) [Recd. April 1933.]

An account is given of observations on the bionomics of *Eriosoma lanuginosum*, Htg., and the Buprestid, *Capnodis tenebrionis*, L., which cause severe damage to fruit trees in Georgia and of experiments on their control by soil fumigants. A key to the species of *Capnodis* occurring in Transcaucasia is included, showing their food-plants and local distribution.

C. tenebrionis was only found on apricots and sometimes on pear, though in the insectary the beetles fed on shoots of other fruit trees. The bionomics are similar to those recorded in Italy [*R.A.E.*, A, xix, 625]. Hibernation occurs in the larval stage in the galleries in the

roots, and as adult beetles, probably in the soil. Young females emerge with undeveloped ovaries and require supplementary feeding. The place of oviposition was not ascertained, but eggs are probably laid below the root collar and on the upper roots. Pupation occurs in a chamber made in fairly thick roots or immediately below the collar. Development is favoured by dry and hot weather ; if humidity is sufficient, the infested parts of the trees exude resin, which drowns the larvae. The beetles were occasionally attacked by mites, and the pupae and young adults in the pupal chambers were preyed upon by the Elaterid, *Melanotus rufipes*, Hbst.

E. lanuginosum was only found on pear and quince. On one-year-old trees the colonies occurred on all roots and particularly on the main one immediately below the collar, whereas on older trees they chiefly infested the finer roots. No galls are formed. The number of individuals in a colony seldom exceeded 100. Soil examinations showed 44 per cent. of the Aphids at a depth of about 8 ins., 33 per cent. at 8–16 ins., 20 per cent. at 16–24 ins., and 3 per cent. deeper. Only single individuals were found on the roots in winter, spring and early summer, the maximum infestation being reached at the end of the summer, probably owing to migration from elms. Maturing and adult alate individuals, which together constituted in some instances 30 per cent. of the whole colony, were present in the second half of September.

Soil fumigants were applied against the larvae and young adults of *Capnodis tenebrionis* at intervals from 24th March till 8th August, the results being estimated 15–20 days after treatment. Their effectiveness was considerably impaired by constant rain and the hard, compact nature of the soil. Since the larvae are usually found near the root collar, the fumigants were applied in holes or circular furrows 3–4 ins. deep and 4–5 ins. from the trees and covered with soil. Carbon bisulphide and calcium cyanide proved quite ineffective, but paradichlorobenzene sometimes gave a high rate of mortality (95 per cent. in the most successful experiment when used at the rate of 2¼ oz. to a tree). It was much less effective when placed in holes than when applied in the circular furrow. The adult beetles may also be controlled by jarring them off the trees and collecting them before oviposition has started. Keeping the soil under the trees sufficiently damp will reduce the injury caused by the larvae to the roots and assist the development of the resistance of the trees.

The experiments with fumigants against *E. lanuginosum* were conducted from 10th September till 12th October, the results being estimated after 2–5 days. They were usually applied in the same manner as in the tests against *Capnodis*. Differences in the compactness of the soil affected their diffusion and consequently their effect on individual colonies of Aphids, even in the same experiment. Carbon bisulphide proved to be the most effective, its toxicity increasing in the deeper layers. Thus when applied at the rate of 26 cc. per tree, it killed 93 per cent. of the Aphids at a depth of 0–8 ins., and all below this depth. Emulsification with kerosene did not increase its toxicity. It did not injure the trees, but the author believes that it might do so if applied in large quantities in the field and might also prove too expensive for use. Paradichlorobenzene and calcium cyanide were much less effective ; the former was more toxic in the upper soil layer and the latter at depths below 8 ins. The comparative failure of paradichlorobenzene, however, may be explained by the low temperature of the soil in the autumn, which was below 25°C. [77°F.].

LIMING (O. N.). **The Preparation and Properties of Pentathionic Acid and its Salts ; its Toxicity to Fungi, Bacteria and Insects.**—*Phytopathology*, xxiii, no. 2, pp. 155–174, 1 fig., 16 refs. Lancaster, Pa., February 1933.

The studies described included tests of pentathionic acid (the principal acid formed by the reaction of sulphur dioxide and hydrogen sulphide in water) as an insecticide, made on *Aphis rumicis*, L., *A. spiraecola*, Patch, and *A. gossypii*, Glov. Small plants or twigs infested with the Aphids were set up in distilled water in the laboratory and thoroughly sprayed with either pentathionic acid, nicotine sulphate or water, potash fish-oil soap (0·5 per cent.) being used as a spreader in all the sprays. The Aphids were examined after 24 hours. A 0·02 per cent. concentration of the acid appeared to be about as toxic as the same concentration of nicotine sulphate to *A. rumicis* and *A. spiraecola* and about half as toxic to *A. gossypii*.

GOOD (N. E.). **Biology of the Flour Beetles,** *Tribolium confusum* **Duv. and** *T. ferrugineum* **Fab.**—*J. Agric. Res.*, xlvi, no. 4, pp. 327–334, 4 refs. Washington, D.C., 15th February 1933.

A preliminary account is given of extensive work on the Tenebrionids, *Tribolium confusum*, Duv., and *T. castaneum*, Hbst. (*ferrugineum*, F.), which are among the more serious pests of flour, meal and other cereal products. Characters distinguishing the two species are described, with a brief account of new observations on their external anatomy, and their origin and habitat are discussed. Their distribution seems influenced by temperature ; *T. castaneum* rarely occurs north of 40°N. Lat., whereas *T. confusum* is most abundant in cooler regions. Chocolate, raisins and various nuts, especially walnuts, also serve as food for the larvae. In the central and northern parts of the United States, hibernation occurs in the adult stage, but in the Gulf States breeding probably continues throughout the year, and in the extreme northern states the species probably cannot survive the winter except in heated buildings. The maximum length of life of the adults has not been determined, but 13 out of the 50 adults of *T. confusum* under observation were alive after 24 months, and 5 out of 60 of *T. castaneum* were alive after 23. Twenty-five pairs of each species were segregated on emergence and each pair was placed in a separate, stoppered receptacle, five or six different cereal foods being given under different conditions of temperature and humidity. The adults were moved to a clean receptacle daily. The numbers of eggs laid each day, of which approximately 90 per cent. hatched, were estimated by counting the larvae. The longest oviposition period was 432 days for *T. confusum*, when fed on whole-wheat flour, and 308 for *T. castaneum*, when fed on oatmeal, at room temperature. The greatest number of eggs was 976 for *T. confusum*, when fed on whole-wheat, and 956 for *T. castaneum* when fed on maize meal, at room temperature. The average number of eggs laid per day was 2 or 3 [*cf. R.A.E.*, A, xix, 209]. The eggs are deposited singly in the flour and are occasionally attached to the sides of the container ; the sticky coating causes flour to adhere to them. Fifty eggs of *T. castaneum* kept at 27°C. [80·6°F.] hatched in an average of 5·5 days, but at an average temperature of 22°C. [71·6°F.] and an average humidity of 32 per cent. the incubation period of 40 eggs averaged 8·6 days. The average incubation period of 40 eggs of *T. confusum* at 27°C. was 6·8 days. Of these, 17 kept in continuous

light averaged 6·5 days and 23 kept in continuous darkness averaged 7. At averages of 21°C. [69·8°F.] and 34 per cent. humidity the average incubation period was 12·8 days. Over 100 eggs of both species were placed in individual receptacles under varying conditions of food, temperature and humidity, and observed daily. The exuviae were used as records of the moults, the number of which ranged from 6 to 11 but was normally 7 or 8. The shortest life-cycles were recorded on walnuts, and at 27°C., which was more favourable to development than room temperature, the larval period varied from 27 to 90 days according to the food. It was slightly longer for *T. confusum* than for *T. castaneum*. Measurements of the head capsules of the larvae of *T. confusum* are recorded. Pupation takes place on the surface of the food. The pupal period at 27°C. averaged 8·2 days for *T. confusum* and 7·1 for *T. castaneum*.

Two mites, *Acarophenax tribolii*, Newst. & Duv. [xx, 218] and *Pediculoides ventricosus*, Newp., and a Bethylid, *Rhabdepyris zeae*, Turn. & Wtstn., have been recorded as parasites, but none seems effective in control.

MUESEBECK (C. F. W.) & PARKER (D. L.). *Hyposoter disparis* **Viereck, an introduced Ichneumonid Parasite of the Gipsy Moth.**—*J. Agric. Res.*, xlvi, no. 4, pp. 335–347, 4 figs., 1 map, 9 refs. Washington, D.C., 15th February 1933.

An account is given of the distribution, morphology, bionomics and economic importance of *Hyposoter disparis*, Vier., a parasite of *Porthetria dispar*, L., first introduced into the United States from Europe in 1907. All stages are described. Hibernation occurs as an adult in the cocoon, and emergence was observed in out-door cages from about 25th April to 10th May. It was found that 65°F. or more and direct sunlight were necessary for pairing. Oviposition takes place in active larvae of *P. dispar* of the 1st and 2nd instars, one or more eggs being laid in each, although only one parasite matures. In experiments with 10 isolated females, the average number of eggs deposited per female was 561, and the oviposition period usually lasted until death, although one female which lived 54 days only oviposited for 34. The incubation period is usually about 7 days, but at low temperatures may be 10. There are 5 larval instars, all of which occur within the host larva ; by dissection of the latter it was determined that they lasted 5–10, 2–5, 2–4, 2–4 and 1–2 days respectively. On emergence of the mature larva, the host caterpillar is left as an empty skin, death usually occurring when the parasite is in the 4th instar. The period from oviposition to cocoon formation was 20–33 days at an average mean temperature of 63·7°F. in 1929 and 27–41 days at 57·6°F. in 1931. The cocoons are only weakly attached to the host or tree and, apparently always, drop to the ground within 48 hours. Pupation occurs 9–10 days after cocoon formation, and transformation to the adult 20–21 days later. The adult stage is normally attained during the first half of July, but emergence does not occur until the following spring, there being but a single generation annually. Rarely, a male adult may emerge in the same season. A list of hyperparasites reared from cocoons received from Italy in 1911 and 1912 is given.

H. disparis has not become an important parasite of the gypsy moth in New England, but in 1929, 1930 and 1931, 5–7 per cent. parasitism was noticed. There was 28 per cent. parasitism in larvae collected from the interior of a wood in 1930 and only 4 per cent. in those from

the edges. The parasitism of *P. dispar* is probably not complete since the eggs and larvae of the parasite commonly failed to develop and become surrounded by host phagocytes. The phagocytic reaction of the host is briefly discussed [*cf. R.A.E.*, A, xviii, 570].

SILVER (J. C.). **Biology and Morphology of the Spindle Worm, or Elder Borer.**—*Tech. Bull. U.S. Dept. Agric.*, no. 345, 19 pp., 9 figs., 8 refs. Washington, D.C., February 1933.

This is an account of the morphology, bionomics and distribution of the Noctuid, *Achatodes zeae*, Harr., which is a pest of several species of elder (*Sambucus*) in the United States and has been recorded as attacking dahlias and maize [*cf. R.A.E.*, A, xviii, 116, 282, 417]. It is not considered of much economic importance. In experiments in a cage and in the field the larvae did not migrate to maize from elder, which is the only plant on which the author has found them.

FELT (E. P.). **Shade Tree Insects in 1932.**—*Proc. 8th Nat. Shade Tree Conf.*, pp. 76–81. Rochester, N.Y., 1932. [Recd. April 1933.]

The following pests are among those not already mentioned as infesting shade trees, etc., in the United States during 1932 [*R.A.E.*, A, xx, 300, 430, 643, 644 ; xxi, 231] : *Plagiodera versicolora*, Laich., which was more generally abundant and destructive on willows than in 1931 [xx, 284] ; *Thyridopteryx ephemeraeformis*, Haw., which occurs primarily in the south, but has been locally abundant on trees or groups of trees in New York ; a species of *Pulvinaria*, probably near *floccifera*, Westw., which caused somewhat severe damage to the twigs of yew (*Taxus*) in Connecticut ; *Coleophora limosipennella*, Dup., and *Kaliofenusa ulmi*, Sund., which were locally abundant as defoliators of elm in southern New York and the former also in southern New England ; *C. salmani*, Heinr., which was present for the first time on birch in Maine and which has also been provisionally identified from New Hampshire ; *Nepticula sericopeza*, Zell., which is not usually destructive, although it breeds in large numbers in the seeds of Norway maple in southern New England and south-eastern New York ; *Paratetranychus ununguis*, Jac., which has been generally prevalent on spruce in southern New England, south-eastern New York and northern New Jersey ; and *Tetraneura ulmifoliae*, Baker (*ulmisacculi*, Patch), which was found in considerable abundance on English elm in Massachusetts.

GAMBRELL (F. L.). **Studies of some Insects of Evergreens.**—*Proc. 8th Nat. Shade Tree Conf.*, pp. 89–93, 3 refs. Rochester, N.Y., 1932. [Recd. April 1933.]

Brief notes are given on the biology of *Chermes* (*Adelges*) *abietis*, L. (spruce gall aphis) [*cf. R.A.E.*, A, xv, 189 ; xix, 479] and *C.* (*Gillettea*) *cooleyi*, Gill. (Sitka gall aphis) and their control on spruce in New York. Satisfactory results may be obtained with a single application of commercial lime-sulphur (1 : 8) or 1 U.S. pt. nicotine sulphate and 5 lb. soap to 100 U.S. gals. water. The nicotine spray is most effective at 50°F. or over. Lime-sulphur (1 : 40) has also proved satisfactory, and the application during late autumn or early spring of a 2 per cent. nicotine-lime dust apparently afforded good protection against *C. abietis*. Oil sprays have given effective control, but may injure the foliage even at strengths of one or two per cent.

Otiorrhynchus (*Brachyrrhinus*) *ovatus*, L. (strawberry root weevil) and *O.* (*B.*) *sulcatus*, F. (black vine weevil) have been observed attacking several varieties of coniferous nursery stock in western New York and have also been recorded on coniferous seedlings in Michigan [xx, 635] and on *Taxus* in Massachusetts. The injury is chiefly caused by the larvae feeding on the root-hairs and smaller roots, the outer layers of the larger roots and the bark near the surface of the soil. None of the materials, such as naphthalene and lead arsenate, tested against the larvae in the soil apparently proved effective. A poison bait of calcium arsenate, molasses and bran, 200 lb. of which was sufficient for about 4,000–5,000 trees, gave an average mortality of over 75 per cent. of the adults when placed round the base of the stems.

PARROTT (P. J.). **Spray Problems, Old and New.**—*Proc. N.Y. St. Hort. Soc.*, lxxviii (1933), pp. 5–14. Leroy, N.Y., 1933.

Owing to bad markets and export restrictions, a great deal of fruit was left unharvested in 1932, especially in western New York, and spray programmes were often reduced. The increased infestation of fruit-flies [*Rhagoletis fausta*, O. S., and *R. cingulata*, Lw.] in unharvested cherry orchards was not enough to warrant a special late arsenical spray, but in one unharvested orchard that was not sprayed during the season, an infestation of 8 per cent. developed. The increase of the apple maggot [*R. pomonella*, Walsh] and the codling moth [*Cydia pomonella*, L.] in neglected apple orchards was more serious.

The results obtained with various sprays against *C. pomonella* are compared. Lead arsenate in combination with mineral oil gave the best control, but if oil is used, its compatibility with other materials, especially fungicides, should be given careful consideration.

FARLEY (A. J.). **Some Experiences with Spraying and Spray Residue Removal in New Jersey.**—*Proc. N.Y. State Hort. Soc.*, lxxviii (1933), pp. 87–92. Leroy, N.Y., 1933.

The arsenical residue problem has led to a decrease of late spraying of apples in New Jersey, which has been followed by an increase in the numbers of the codling moth [*Cydia pomonella*, L.]. Methods are described of washing fruit [*cf. R.A.E.*, A, xviii, 474 ; xx, 221, etc.], and the use of a nicotine tannate spray [xix, 358] is suggested for certain varieties likely to be damaged in washing.

CHASE (A. R.). **The Uses of the Moth Traps.**—*Proc. Wash. St. Hort. Ass.*, xxviii (1932), pp. 38–44. Wenatchee, Wash. [1933.]

CLEMENTS (C.) **Experience with Codling Moth Traps.**—*T c.*, p. 45.

Chase suggests that traps for the codling moth [*Cydia pomonella*, L.] [*cf. R.A.E.*, A, xv, 592, etc.] might be used not only for timing sprays but as a supplementary control. As they apparently catch a larger proportion of summer-brood than of overwintered moths, they might even entirely replace second-brood sprays.

Clements states that he obtained better results in Washington State in 1932, when he applied a 4th first-brood lead arsenate spray in June and relied for the rest of the season on traps (about 20 per acre), than in 1931, when, without using traps, he applied 3 first-brood sprays, followed in July by 3 second-brood ones, of which the last 2 were oil and lead arsenate combinations.

Webster (R. L.), Marshall (J.), Miller (C. E.) & Hansberry (T. R.). **Fish Oils, Spreaders and Non-arsenicals for Codling Moth Control.**—*Proc. Wash. St. Hort. Ass.*, xxviii (1932), pp. 48–64, 8 figs. Wenatchee, Wash. [1933.]

In experiments in Washington State, sprays of 2 lb. lead arsenate to 100 U.S. gals. plus 1 U.S. qt. fish-oil gave as good control of the codling moth [*Cydia pomonella*, L.] as a stronger concentration (3 lb. to 100 U.S. gals.) without fish-oil [*cf.* *R.A.E.*, A, xx, 277, 278]. Apples so sprayed throughout the season, when cleaned with 1·5 per cent. hydrochloric acid at 110°F., retained 0·006 grains arsenic per lb. [*cf.* xx, 279 ; xxi, 255]. The best fish-oils were those that cause a high arsenic deposit, are clear, remain liquid at low temperatures and dry slowly. The best results were obtained with Pacific Coast herring oil and with dogfish oil. The addition of ½ lb. of a commercial spreader to a lead arsenate spray (3 lb. to 100 U.S. gals.), while increasing rather than diminishing the arsenic deposit, left actually less residue after washing (0·003 : 0·004 grains). By substituting a spray of lead arsenate (2 lb. to 100 U.S. gals.) plus mineral oil (0·8 per cent.) for lead arsenate (3 lb. to 100 U.S. gals.) alone in the first 3 cover sprays, the number of larvae per 100 fruit was reduced from 23 to 15. An oil-nicotine combination in second-brood cover sprays has continued to give as good control as lead arsenate, but oil-pyrethrum failed in 1932 to check late larvae. Spraying throughout the season with 3 lb. natural cryolite to 100 U.S. gals. plus 1 U.S. qt. fish-oil gave slightly better results than the normal lead arsenate sprays.

Yothers (M. A.). **The Relation of the Woolly Aphid to Perennial Canker of the Apple.**—*Proc. Wash. St. Hort. Ass.*, xxviii (1932), pp. 69–75, 4 figs., 5 refs. Wenatchee, Wash. [1933.]

The treatment recommended for apple trees infected with perennial canker (*Gloeosporium perennans*), which is associated with *Eriosoma lanigerum*, Hausm., is the cutting out of the diseased areas in June–July and the application of a paint consisting of 8 parts resin, 3 parts linseed oil or castor oil and 8–15 per cent. nicotine sulphate. This treatment should be combined with nicotine sulphate sprays to control the Aphid [*R.A.E.*, A, xvii, 667].

Overley (F. L.) & Garver (H. L.). **Residue Removal and its Relation to the Spray Program and Orchard Growing Conditions.**—*Proc. Wash. St. Hort. Ass.*, xxviii (1932), pp. 89–101, 1 fig. Wenatchee, Wash. [1933.]

Experiments have been made in the removal of spray residue from apples by means of a specially devised washer, which is described in detail. The apples remained in the washing solution for 38 seconds. Every lot of fruit tested was cleaned below the limit of tolerance (0·01 grains As_2O_3 per lb.) by one treatment or another. Hydrochloric acid (1·5 per cent. at 110°F.) was generally satisfactory. Soda ash [sodium carbonate] (75 lb. to 100 U.S. gals. at 110°F.) was fairly satisfactory with average samples ; nothing was gained by increasing the concentration. A fresh solution of trisodium phosphate (75–100 lb. to 100 U.S. gals.) gave generally the best results, especially with the addition of 1 U.S. qt. of odourless kerosene. Sodium silicate cleaned every lot of fruit at some concentration and some temperature ; in the case of a variety difficult to clean, the concentration at 110°F.

was 100 lb. to 100 U.S. gals. plus 1 U.S. qt. kerosene, and at 120°F. it was 75 lb. plus 1 U.S. pint kerosene.

Apples sprayed with lead arsenate alone (2–3 lb. to 100 U.S. gals.) were satisfactorily cleaned with HCl or the sodium compounds (50 lb. to 100 U.S. gals. at 110°F.). After a stronger spray (6 lb. to 100 U.S. gals.), it was necessary to increase in the case of the latter either the concentration or the temperature. The addition to the spray of different proportions of fish-oil made it increasingly difficult to remove residues with HCl or Na_2CO_3, but positively easier with Na_3PO_4 or Na_2SiO_3. The addition of mineral oil made the removal more difficult with any washer; the sodium compounds, especially with kerosene, were generally more effective than HCl. Residues containing both fish-oil and mineral oil were removed more easily than those containing only mineral oil by Na_3PO_4 and Na_2SiO_3 but not by the others. A preliminary water washing is recommended as keeping the actual washing solution cleaner, though it does not greatly affect the ultimate residue. The amount of residue on the apples at harvest is not a true criterion of the difficulty of cleaning. The hardest fruit to clean is that grown under adverse or abnormal conditions, often associated with infestation by mites, late drought or winter injury. Some lenticel injury was noticed in cold storage, especially in fruit treated with a preliminary spray of 25 per cent. kerosene emulsion and then washed with HCl. Washing with Na_2CO_3 or Na_3PO_4 at 110°F. or higher was liable to crack the skin, but Na_2SiO_3 was harmless at 120°F. and sometimes even at 130°F. Easily cleaned fruit was more liable to such injury.

Dolman (C. D.). **Detergents and Use in Residue Removal.**—*Proc. Wash. St. Hort. Ass.*, xxviii (1932), pp. 102–117, 3 graphs, 12 refs. Wenatchee, Wash. [1933.]

This is a comparison, based on various experiments, of the chemical properties of soda ash [sodium carbonate], trisodium phosphate and sodium silicate with reference to their efficiency in removing spray residue and their probable effect on the skin of fruit. Some of the conclusions are the same as those in the preceding paper. Sodium silicate is the least likely to injure the fruit and keeps its cleansing powers longest; one solution cleaned 28,000 boxes of apples, and it could be continually renewed by further additions of the salt, whereas trisodium phosphate (100 lb. to 100 U.S. gals.) broke down after 3,000 boxes had been treated, and further additions failed to renew it.

Doucette (C. F.). **The Gladiolus Thrips.**—*Proc. Wash. St. Hort. Ass.*, xxviii (1932), pp. 290–293, 1 ref. Wenatchee, Wash. [1933.]

Since 1930, *Taeniothrips gladioli*, Moult. & Stnw., has attracted increasing notice in the eastern United States as a pest on *Gladiolus*. Among the treatments recommended for the stored corms [*R.A.E.*, A, xx, 421, 531, 702; xxi, 230] are immersion for 7 hours in hydroxymercurichlorophenol (Semesan) at 1½ lb. to 100 U.S. gals. water, this being more reliable than mercury bichloride; immersion for 20–30 minutes in water at 110°F.; and vapour heat treatment at the same temperature for four hours. The most practical method of control is considered to be sprinkling the corms with naphthalene flakes (1 oz. to 100 corms) [xxi, 256], and growers are recommended to practise this even where no infestation is observed.

Papers noticed by Title only.

Moulton (D.). **The Thysanoptera of South America (I) (II).**—*Rev Ent.*, ii, fasc. 4, pp. 451–484, 3 figs.; iii, fasc. 1, pp. 93–133 14 figs. Rio de Janeiro, 1932–33.

del Cañizo (J.). **Tisanópteros de la península ibérica.** [A preliminary List of the Thysanoptera of Spain and Portugal.]—*Bol. Pat. veg. Ent. agríc.*, vi (1931), no. 23–26, pp. 98–109, 1 fig., 28 refs. Madrid, 1932. [Recd. April 1933.]

Balachowsky (A.). **Contribution a l'étude des coccides de France. (14e note). Nouvelles recherches sur la faune indigène de la Corse** [including 2 new species].—*Ann. Soc. ent. Fr.*, cii, pp. 35–50, 4 pls., 11 refs. Paris, 30th March 1933.

Miller (F. W.). **Several Species of Oak Aphids from Massachusetts (Homop.: Aphidae).**—*Ent. News*, xliv, no. 4, pp. 105–107. Philadelphia, Pa., April 1933.

Granovsky (A. A.). **Two new Genera and Species of Aphidae (Homoptera)** [on oak].—*Proc. Ent. Soc. Wash.*, xxxv, no. 3, pp. 29–43, 15 figs., 14 refs. Washington, D.C., March 1933.

Crosby (C. R.) & Chupp (C.). **The Control of Diseases and Insects affecting Vegetable Crops** [in New York State].—*Cornell Extens. Bull.*, no. 206 revd., 101 pp., 11 figs. Ithaca, N.Y., N.Y. St. Coll. Agric., January 1933. [*Cf. R.A.E.*, A, xix, 366; xx, 192.]

Schwardt (H. H.). **Life History of the Lesser Grain Borer** [*Rhizopertha dominica*, F.].—*J. Kansas Ent. Soc.*, vi, no. 2, pp. 61–66, 9 refs. McPherson, Kans., April 1933. [*Cf. R.A.E.*, A, xx, 126.]

Putman (W. L.). **Chrysopids as a Factor in the Natural Control of the Oriental Fruit Moth** [*Cydia molesta*, Busck, in Ontario].—*62nd Ann. Rep. Ent. Soc. Ontario 1931*, pp. 44–45, 2 refs. Toronto, 1932. [Recd. March 1933.] [*Cf. R.A.E.*, A, xx, 513.]

Uchida (T.). **A new Parasite of** ***Laspeyresia*** **[*Cydia*]** ***molesta*** **Busck** [*Angitia* (*Dioctes*) *molestae*, sp. n., in Japan].—*J. Wash. Acad. Sci.*, xxiii, no. 3, pp. 147–148, 1 fig. Menasha, Wis., 15th March 1933.

Constantineanu (M. I.). **Nouvelles contributions à la faune ichneumonologique de la Roumanie. (Suite de l'étude sur les Ichneumonides en Roumanie). Subfamilia Ophioninae Cresson.**—*Ann. sci. Univ. Jassy*, xvii, pp. 231–293, 40 refs. Jassy, January 1933. [*Cf. R.A.E.*, A, xix, 129.]

Varley (G. C.) & Butler (C. G.). **The Acceleration of Development of Insects by Parasitism.**—*Parasitology*, xxv, no. 2, pp. 263–268, 14 refs. Cambridge, April 1933.

Buhr (H.). **Mecklenburgische Minen. I. Agromyziden-Minen. II. Coleopteren-, Tenthrediniden- und Dipteren-Minen** [arranged under food-plants].—*Stettin. ent. Ztg.*, xciii, no. 1, pp. 57–115, 15 refs.; xciv, no. 1, pp. 47–96, 35 refs. Stettin, 1932–33.

[Manzenko (G.).] **Манзенко (Г.). The Control by Mechanical Methods of Pests and Diseases of Agricultural Plants** [an account of equipment for spraying, dusting and fumigation]. [*In Ukrainian.*]—Demy 8vo, 160 pp., 72 figs. Kharkov, DSGV [State Agric. Pub.], 1933. Price *Krb.* 2.

Ricks (G. L.) & Toenjes (W.). **Success and Failure in Spraying for Scab and Codling Moth.**—*Spec. Bull. Michigan Agric. Expt. Sta.*, no. 230, 32 pp., 22 figs., 2 refs. East Lansing, Mich., January 1933.

It was found that different apple growers in Michigan, apparently using identical methods of control against the codling moth [*Cydia pomonella*, L.] under identical conditions, were in practice obtaining very different results. Of two orchards 2½ miles apart, where similar spray schedules were used, one showed 0·5 and 2·9 per cent. infested fruit in 1930 and 1931, and the other 13·5 and 19·3. An attempt was made to explain these differences by comparison of spraying methods [*cf. R.A.E.*, A, xx, 570]. The most important factor was found to be the thoroughness with which the top central part of the tree was covered. Sufficient allowance was rarely made for the drop of a long jet when the operator stood on the tank, and results were much improved by aiming definitely over and not at the top of the tree. It was also found that, whereas in an unsprayed tree 75 per cent. of the larvae had entered the apples from the side facing outwards, in sprayed trees at least 66 per cent. had entered from the inner side, evidently because this was less covered by the spray. It was therefore essential to direct the spray into and through the trees. For this purpose spraying from the ground was effective as a supplementary measure on dense trees. A rod with more than 2 nozzles lacked penetrating power when used on large trees late in the season. The authors stress the importance of dating sprays in each orchard by means of moth traps, and of using such supplementary measures as scraping and banding, but they are convinced that almost perfect control could be obtained with the spraying materials and schedules at present in use if more care were taken to ensure complete coating.

Herrick (G. W.). **An Unusual Invasion of the Clothes Moth,** *Tineola bisselliella* (**Lepid. : Tineidae**).—*Ent. News*, xliv, no. 4, pp. 99–101. Philadelphia, Pa., April 1933.

Serious infestation of houses by *Tineola bisselliella*, Humm., was found to have originated in a room in a warehouse about 150–300 ft. away containing about 20 tons of raw wool, some of which had been in storage for at least two years. Many of the fleeces were practically destroyed. An interesting feature was the fact that the moths, apparently overcrowded in their original breeding-place, had begun to migrate to less crowded ones.

Clark (E. P.). **The Occurrence of Rotenone and related Compounds in the Roots of** *Cracca virginiana*.—*Science*, lxxvii, no. 1995, pp. 311–312, 6 refs. New York, 24th March 1933.

As *Tephrosia* (*Cracca*) *virginiana*, the most abundant species of its genus indigenous to the United States has been reported to possess insecticidal properties [*R.A.E.*, A, xix, 319, 549] and *T.* (*C.*) *toxicaria* from South America and *T.* (*C.*) *vogelii* from Africa have yielded substances related to the rotenone group of fish poisons [xviii, 690; xix, 308], an investigation is being carried out in Washington into the chemical properties of *T. toxicaria*, and the results so far obtained

are here recorded. Ether extraction of the roots yielded 4–6 per cent. of resinous material, which showed essentially the same toxicity for fish as pure rotenone. It contained 9 per cent. methoxyl and in many ways resembled the non-crystallisable extractives from derris and cubé roots [xviii, 376]. Attempts to obtain individual major constituents by distillation, crystallisation, or the formation of derivatives were for the most part unsuccessful, although rotenone, dehydrorotenone, tephrosin and a colourless crystalline material ($C_{22}H_{24}O_4$) melting at 131°C. were obtained in small quantities. The methods of obtaining these substances are described.

HARLAND (S. C.) & ATTECK (O. M.). **Breeding Experiments with Biological Races of *Trichogramma minutum* in the West Indies.**—*Z. indukt. Abstamm.- u. VererbLehre*, lxiv, no. 1–2, pp. 54–76, 12 refs. Leipzig, 1933.

The object of the experiments described was to collect strains of *Trichogramma minutum*, Riley, from various localities in the West Indies, to examine their morphological and physiological characters and by means of controlled crossing experiments to obtain information on their relationships. *Sitotroga cerealella*, Ol., and *Corcyra cephalonica*, Staint., were used as hosts for laboratory culture of the various races, which were classified into three groups on the basis of colour differences and on the type of parthenogenesis involved. In addition to nine West Indian strains, two American strains were used for comparison. Two races were found to produce females only, this being the first record of such races from the New World. Constant differences in reaction to various hosts were established for the strains tested. Crossing experiments, involving a large number of combinations, revealed only one fertile inter-West Indian one, the strain from Antigua proving partially fertile with that from Barbados. Segregation of colour was observed in subsequent generations, and ultimately a new strain characterised the mass culture, possessing the coloration of the Antigua strain with the ability of the Barbados strain to parasitise *S. cerealella*.

The bearing of the experiments upon evolutionary and taxonomic problems is discussed, and it is concluded that it is best not to erect new species from the mutually uncrossable forms described, but to treat them as physiological races.

CHERIAN (M. C.). **South Indian Acarina.**—*J. Asiat. Soc. Bengal*, xxvii (1931), no. 1, pp. 141–147. Calcutta, February 1933.

This list of 23 mites from Southern India gives their food-plants and details of their distribution, with notes on the damage they cause and, in most cases, on their bionomics.

One of the most destructive is *Paratetranychus indicus*, Hirst, a serious pest of *Sorghum*. Its life-cycle is completed in 10–12 days, and parthenogenesis is common. The Coccinellid, *Scymnus gracilis*, Motsch., *Scolothrips sexmaculatus*, Perg., and the Staphylinid, *Liophaena gracilipes*, Sharp (*Oligola flaviceps*, Sharp), are predacious on the mite and its eggs. *Tetranychus telarius*, L., is a serious pest of hemp (*Cannabis sativa*). *T. hindustanicus*, Hirst, attacks the leaves of *Citrus*, and *Raoiella indica*, Hirst, those of coconut.

Röber (H.). **Sind die Wachsmotten Schädlinge?** [Are the Wax Moths Pests?]—*Ent. Rdsch.*, xlix, pp. 249–250; l, pp. 32–53, 62–63, 120.

Hüsing (H.). **Sind die Wachsmotten wirklich keine Schädlinge?** [Are the Wax Moths really not Pests?]—*Op. cit.*, l, no. 2, pp. 9–11.

Krancher (O.). **Die Wachsmotten sind arge Schädlinge!** [The Wax Moths are serious Pests!]—*T.c.*, pp. 11–13.

Manhardt (G.). **Sind Wachsmotten Schädlinge?**—*T.c.*, no. 5, pp. 60–62.

Hüsing (H.). **Noch ein Wort zur Schädlichkeit der Wachsmotten!** [A further Word on the Harmfulness of the Wax Moths.]—*T.c.*, no. 8, pp. 118–119. Stuttgart, December 1932–April 1933.

These papers discuss the question of whether *Galleria melonella*, L., and *Achroia grisella*, F., damage the contents of bee-hives or whether they merely act as scavengers, the latter being the opinion maintained by Röber and opposed by the other contributors, who adduce instances of the destruction of the comb, bee larvae and stored pollen. No agreement on the question is reached.

Sachtleben (H.). **Die San José-Schildlaus,** *Aspidiotus perniciosus*, **Comst.** [The San José Scale.]—*Flugbl. biol. Reichsanst. Land- u. Forstw.*, no. 122–123, 8 pp., 1 col. pl., 7 figs. Berlin, March 1933.

In view of the occurrence of *Aspidiotus perniciosus*, Comst., in Hungary and Austria [*R.A.E.*, A, xx, 506] and the danger of its introduction into Germany, an account is given of its distribution, bionomics and morphology, and the differences between it and two German species, *A. ostreaeformis*, Curt., and *Epidiaspis leperii*, Sign. (*betulae*, auct.), which also occur on apple and pear, are indicated. A brief note on the control measures employed in the United States is included.

Gösswald (K.). **Ueber die Wirkung von Xylamon als Atemgift.** [On the Action of Xylamon as a respiratory Poison.]—*Anz. Schädlingsk.*, ix, no. 4, pp. 45–48. Berlin, April 1933.

Various insecticide washes are being used in Germany for the control of wood-boring larvae, especially *Hylotrupes bajulus*, L. These include Xylamon, a chlorinated hydrocarbon that has given excellent results in practice. An account is given of laboratory experiments, using *H. bajulus* and Lepidopterous larvae and pupae, that demonstrated its value as a respiratory poison. In a subsequent experiment a 2 ft. length of a telegraph pole 12 inches thick infested by larvae of *H. bajulus* was given one coat of "Xylamon hell" on its outside surface, the cut cross surfaces being sealed with paraffin wax. The log was then kept at a temperature of 18–20°C. [64·4–68°F.] and air-humidity of 60 per cent. An examination made 6 weeks later showed that out of 18 larvae 7 were dead, 6 moribund, and 5 alive, these last being in places where the penetration of the chemical was difficult. Examination of the intestines of the larvae showed that they had ceased feeding when reached by the fumes. In comparative jar tests with Xylamon and a tar-distillate, the former proved more effective; such tests are being made with telegraph poles.

Jensen Storch (S.). **Etwas über flüssige Mittel gegen den Hausbock** (*Hylotrupes bajulus*). [Some Remarks on Liquid Insecticides against *H. bajulus*.]—*Anz. Schädlingsk.*, ix, no. 4, pp. 48–50, 1 fig., 4 refs. Berlin, April 1933.

In experiments, the removal of 71 per cent. of the sapwood of timber infested by *Hylotrupes bajulus*, L., removed 69 per cent. of the larvae. Tests of liquid insecticides, painted or sprayed on the timber, should therefore be made by application of the liquid to the surface without any previous removal of the outer layers. The quantity of liquid should be calculated according to the volume of the timber, because it is the sapwood that requires impregnation and its volume is in a more constant relation to the volume of the timber than to its surface. On an average 77 lb. of liquid is required per 35 cub. ft. In cases of incipient attack 55 lb. may suffice, while in severe cases up to 132 lb. will be needed.

Eckstein (K.). **Der Buchenrotschwanz** (*Dasychira pudibunda* **L.**) —*Anz. Schädlingsk.*, ix, no. 4, pp. 52–54, 5 figs. Berlin, April 1933.

Outbreaks of *Dasychira pudibunda*, L., occurred in certain mixed stands of pine and beech at Eberwalde, Germany, in 1889, 1917 and 1932. After defoliating the trees, the larvae attacked the ground flora and then died of hunger. Neighbouring areas were never affected.

Escherich (K.). **Ueber den Teppichkäfer** (*Anthrenus scrophulariae*, **L.**) **und seine Bekämpfung.** [On the Carpet Beetle, *A. scrophulariae*, and its Control.]—*Anz. Schädlingsk.*, ix, no. 4, pp. 57–58. Berlin, April 1933.

In these notes on the Dermestid, *Anthrenus scrophulariae*, L., attention is drawn to the fact that the adult beetles of the genera *Anthrenus* and *Attagenus* do not feed on wool, etc. They live in the open, being often found on flowers, and only enter buildings to oviposit in dark places. *A. scrophulariae* may be controlled by fumigation, but " Eulan " is said to render fabrics proof against both Dermestids and clothes moths.

[Harder (H.).] **Biologische Maikäferbekämpfung.** [Biological Measures against Melolonthid Larvae.]—*Anz. Schädlingsk.*, ix, no. 4, pp. 58–59. Berlin, April 1933.

The author records instances in Schleswig-Holstein of severe infestation of buckwheat by Melolonthid larvae in fields in which clover, etc., had been grown during the previous flight-year [*cf. R.A.E.*, A, xx, 494 ; xxi, 204]. Strawberries and lupins are favourite food-plants of the grubs, and they sometimes migrate to the latter from adjoining buckwheat.

Herford (G. V. B.). **The more important Insect Pests of Cacao, Tobacco and Dried Fruit.**—*Bull. Imp. Inst.*, xxxi, no. 1, pp. 39–55, 1 pl., 14 refs. London, April 1933.

In this paper, which is largely based on the literature, brief descriptions are given of the insects concerned, their biology and the damage

done. Those that attack stored cacao are *Ephestia elutella*, Hb., *E. cautella*, Wlk., *Corcyra cephalonica*, Stn., which is only occasionally found in large numbers, and the Anthribid *Araecerus fasciculatus*, DeG. The chief pests of tobacco are *E. elutella* and *Lasioderma serricorne*, F., and of dried fruit *E. elutella*, *E. cautella* and *Plodia interpunctella*, Hb. A section of the paper deals with fumigation, for which hydrocyanic acid gas has commonly been used, except for small undertakings, when carbon bisulphide or other fumigants have been employed. Recently the use of ethylene oxide, usually mixed with carbon dioxide, has become more general. For work at low temperatures an electric vaporiser has been devised for HCN and a hot water heater for use with ethylene oxide.

DECOUX (L.) & ROLAND (G.). **Compte rendu des recherches effectuées sur la pégomye de la betterave en Belgique en 1932 à l'Institut Belge pour l'Amélioration de la Betterave.**—*Not. Inst. belge Amél. Better. Tirlemont*, 16 pp., 6 figs. Brussels, 15th April 1933.

Continued observations on *Pegomyia hyoscyami* var. *betae*, Curt., on sugar-beet in Belgium [*cf. R.A.E.*, A, xx, 340, 478] showed surprisingly little parasitism (about 3·2 per cent. of the second brood), especially as compared with conditions in Holland [xx, 710], where it reached 50 per cent. in 1931. Of the parasites, the Braconids, *Opius nitidulator*, Nees, and *O. spinaciae*, Thoms., were widespread, *O. fulvicollis*, Thoms., and the Ichneumonid, *Phygadeuon pegomyiae*, Hbm., being more local. Sodium fluoride in sugar solution [xx, 340], used in traps and as a bait-spray, continued to give good results. At a concentration of 0·1 per cent. it was as toxic as at 0·4 per cent., but for practical spraying the latter strength is recommended. In one test it killed 50 flies per sq. yard, but occasional scorching was observed, as too coarse a spray had been applied. In laboratory tests unrefined sugar was as attractive as white sugar, and skimmed milk, used as an adhesive in the spray, did not affect its toxicity. First-brood adults were found to feed before oviposition. Sodium fluosilicate was as effective as sodium fluoride in the laboratory, but not in the field. Coconut-fibre brushes attached to a hurdle, which was drawn twice along the line of the rows in opposite directions, removed 60–70 per cent. of the freshly deposited eggs from the leaves. It is recommended that the beet be sown thick and thinning delayed till after the maximum oviposition (early in May). At the same time other food-plants, such as *Chenopodium* and sheep sorrel [*Rumex acetosella*], should be weeded out. The use of excessive quantities of nitrogenous fertilisers to increase the resistance of the beet is not in itself a sufficient measure of control.

BALACHOWSKY (A.). **Recherches sur l'action insecticide des huiles végétales utilisées en traitement d'hiver contre les cochenilles nuisibles aux arbres fruitiers.**—*C. R. Acad. Agric. Fr.*, xix, no. 14, pp. 497–508, 14 refs. Paris, 26th April 1933.

Since it is generally believed that the toxicity to Coccids of mineral oils depends mainly on their viscosity [*R.A.E.*, A, xx, 18], it was expected that vegetable oils, of equal or greater viscosity though of quite different chemical composition, would prove no less toxic, especially as they had already been used with success against Aphids [xix,

519] and in Algeria against *Chrysomphalus dictyospermi*, Morg., on *Citrus*. A quick breaking emulsion containing 2 gals. ground-nut oil, $\frac{3}{4}$ gal. oleic acid and $\frac{1}{2}$ gal. ammonia to 100 gals. water was applied as a winter spray against third-instar females of *Epidiaspis* (*Diaspis*) *leperii*, Sign., and *Aspidiotus ostreaeformis*, Curt., on pear trees near Paris. A single application killed 98 per cent., whereas of other standard insecticides applied at the same time (white oil [*cf.* xix, 249] carbolineum, etc.), none killed more than 50 per cent. A 10 per cent. colza-oil emulsion also gave 98 per cent. control, but destroyed practically all the flower-buds. The ground-nut oil had no effect on vegetation. The stock emulsion was prepared by stirring a mixture of the oleic acid with the vegetable oil into a solution of $\frac{1}{2}$ gal. commercial ammonia in 2 gals. water. The resulting ammonium oleate is an ideal emulsifying and wetting agent, and danger of scorching is minimised as it is much less caustic than mineral soaps.

BELLIO (G.). **La fumigazione cianidrica negli agrumeti fitti.** [Hydrocyanic Acid Gas Fumigation in dense Citrus Plantations.]—*Ann. Ist. sup. agr. Portici*, (3) vi, pp. 1–23, 2 pls. Portici, 1933.

In Sicily hydrocyanic acid gas is commonly used against scale-insects infesting *Citrus*, and in cases where the trees are close together several are treated simultaneously under the same tent. As compared with the method in which trees are dealt with singly, there is often irregularity in dosage as well as in distribution and loss of gas. A dosage table is given for tents of regular and irregular shapes covering from 1 to 6 trees, and the data on which it is based are discussed. Another system of multiple fumigation, using very large tents covering up to a hundred trees and made of semi-permeable material as light in weight as possible to minimise injury to them, was devised by Sansone Capogrosso [*R.A.E.*, A, xiv, 569] but fell into disuse about 1930 and was not adopted in Sicily. Its advantages were outweighed by reduced efficiency in scale control, which was due chiefly to the insufficient dosages prescribed by the inventor, contributory factors being great irregularity of dosage and distribution in the very large tents employed. It is suggested, however, that this method is capable of giving better results than the ordinary one if more adequate dosages and less porous fabrics are used and the trees are treated in smaller groups when they are dormant or when the fruits are still unripe but not so tender as to be susceptible of injury.

ROUBAUD (E.). **L'anhydrobiose désertique et son influence sur le cycle annuel du criquet pèlerin** (*Schistocerca peregrina*).—*C. R. Acad. Sci. Fr.*, cxcvi, no. 15, pp. 1139–1142, 1 ref. Paris, 1933.

Desert locusts (*Schistocerca gregaria*, Forsk.) can be brought to sexual maturity within 25–28 days after becoming adult, if they are kept at a high temperature and a relative humidity of 50–100 per cent. In a dry atmosphere (35–40 per cent. humidity) and at a temperature of 30–40°C. (86–104°F.), the locusts can be kept sexually immature for many months, without changing their colour, but they become mature in a few days after being transferred to a humid atmosphere. The swarms produced in North Africa in spring and migrating into the Sahara may, therefore, remain immature until the next spring when they again return to cultivated zones.

[VORONTZOVSKIĬ (P. A.).] **Воронцовский (П. А.). Materials for the Study of the Entomofauna of KKASSR**. [*In Russian.*]—*Trud. kompleks. nauch.-issled. Inst. KKASSR*, Kabin. Ent. [*Trans. Complex Inst. sci. Res. KKASSR*, Sect. Ent.], no. 2, 100 pp., 3 refs. Turtkul', 1932. Price 2*r*. 75 *kop*.

This survey of the insect fauna of the Kara-Kalpak Autonomous Soviet Republic, which occupies a region south of the Aral Sea and includes the delta of the Amu-Darya, is divided into three parts. In the first and largest (pp. 3–83), the topography, climate and vegetation of the country near the town of Chimbaĭ in central Kara-Kalpak are discussed, and notes are given on the date of capture, distribution and in some cases food-plants of 476 species of insects collected over a period of about a year in 1930–31. Many species have been introduced, and pests are gradually becoming established with the increase of the area under cultivation. About 16 per cent. of the insects recorded are parasites and predators, and the hosts of some are indicated. The absence of bumble-bees and *Meliturga*, which are widely distributed pollinators of clover in the Russian Union, renders the cultivation of this crop impossible. The second part (pp. 84–94) contains brief notes on 23 Acridids and 3 Mantids found in other parts of the republic, and the third comprises a list of 25 insects collected in one locality in the south of it.

HOFFMANN (W. E.). **The Biology and Control of *Laccoptera chinensis* F. (Coleoptera, Chrysomelidae).**—*Lingnan Sci. J.*, xii, no. 2, pp. 259–260, 1 pl. Canton, 4th April 1933.

The Cassidid, *Laccoptera quadrimaculata*, Thnb. (*chinensis*, Boh. nec F.) is sometimes a serious pest of sweet potato (*Ipomoea batatas*) throughout Kwangtung Province and in Hainan Island, young plants being destroyed by both larvae and adults. *I. purpurea* is also attacked. All stages, which are briefly described, occur on the leaves, and there may be as many as six overlapping generations from early spring to late autumn. The eggs hatch in 2 days in summer, and during September and October the larval stage lasted 13–18 days and the pupal stage 5–10. In the laboratory, individual adults oviposited for over 2 months.

Hand-picking of all stages is recommended ; it should begin as soon as the overwintering adults appear. In seed beds, a spray of 1 lb. lead arsenate to 50 gals. water may be used.

HEADLEE (T. J.). **The Effect of Radio Waves on internal Temperatures of certain Insects.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 313–319, 1 graph, 15 refs. Geneva, N.Y., April 1933.

Living organisms subjected to radio waves in the electrostatic field [*R.A.E.*, A, xix, 486 ; xx, 419] are primarily affected by the development of internal heat. Electric energy pervading this field is absorbed by the organism and largely transformed into heat energy. Theories as to how this occurs are briefly discussed. To produce lethal effects, heat accumulation within the living organism must greatly overbalance heat radiation from its external surface, which increases as the internal temperature rises.

In a study, the technique of which is described, of the thermal death point of third instar larvae of the Japanese beetle [*Popillia japonica*, Newm.], with a frequency of 3,000,000 cycles, the internal temperature

immediately after death ranged from 112 to 104°F. with an average of 107·3 for a field strength of 4,000 volts per linear inch, the corresponding figures for 4,585 volts being 109, 104 and 107°F., and for 5,240 volts 107, 103 and 105°F. When the larvae are exposed to a field strength of 2,000 volts, heat radiation balances heat production long before the thermal death point can be reached. For 4,000 volts, the time necessary to kill ranges from 90 to more than 180 seconds ; and for 5,985 volts it ranges from 60 to a little more than 120 seconds with an average of 90. Thus at 4,000 volts the time is twice as long as at 5,895, whereas the field strength is only one-third less. It is therefore obvious that the economical and practical procedure is to increase the field strength, as measured in volts per linear inch, to the point of prompt destruction of the insect.

Sweetman (H. L.). **Ecological Studies in Relation to the Distribution and Abundance of Economic Pests.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 320–325, 36 refs. Geneva, N.Y., April 1933.

The following is taken from the author's abstract and summary : Methods and technique that can be used to obtain information from which the establishment, abundance, dispersal, control and eradication of insect pests can be predicted are briefly reviewed from the literature. Evidence is submitted showing that annual abundance and dispersal of some insects, especially those that require one or two seasons to assume outbreak proportions, can be forecast, whereas pests that reach epidemic numbers in any season if the environment is favourable present a more difficult problem. Examples are given of controlled laboratory experiments, where climate is simulated and quantitative data collected under natural conditions, which together with correlative studies afford a good means of analysing and forecasting outbreaks. It is suggested that this means of ecological approach might be used to facilitate both quarantine regulations and measures for control and eradication of insect pests.

Schoene (W. J.). **Spray Tests for the White Apple Leafhopper** *Typhlocyba pomaria.*—*J. Econ. Ent.*, xxvi, no. 2, pp. 325–329. Geneva, N.Y., April 1933.

Two apple orchards in Virginia, one consisting of 15-year-old bearing trees and the other of 5-year-old trees, were sprayed at the end of August 1932 for the control of the second brood of *Typhlocyba pomaria*, McAtee (white apple leafhopper). A single application of a spray consisting of 1 gal. summer oil and ¾ pt. 40 per cent. nicotine sulphate to 100 gals. water proved effective when made while the leafhopper was still in the nymphal stage. A combination consisting of ½ gal. penetrol and ½ pt. 40 per cent. nicotine sulphate to 100 gals. water also proved effective against the nymphs, and neither spray caused injury to fruit or foliage. Drenching the foliage with 1 per cent. summer oil without nicotine gave good results against the young nymphs up to the third instar.

P. Garman stated that in experiments carried out in 1932 in Connecticut to compare the effect of nicotine sprays applied with and without soap, no increase was secured in the mortality of nymphs of *T. pomaria* from the addition of soap. In New York P. J. Parrott secured excellent results from the application of combinations of nicotine and lime-sulphur against the first generation nymphs.

Garman (P.). **Notes on breeding** ***Macrocentrus ancylivorus*** **from reared Hosts.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 330–334, 1 ref. Geneva, N.Y., April 1933.

Methods employed in Connecticut for breeding the oriental fruit moth [*Cydia molesta*, Busck] and its parasite, *Macrocentrus ancylivora*, Rohw., are described. Eggs of *C. molesta* are obtained in a greenhouse incubator regulated to 75–80°F. at sunset, after which most of the eggs are laid. Oviposition is effected on peach seedlings in contact with the top of the cage, where most of the moths congregate. As tests have shown that more larvae mature in green apples than in ripe fruit or peach twigs, the larvae are transferred when quite young to such apples, which are kept in cold storage for the purpose. Hibernation is prevented by bringing all stock indoors in August and breeding continuously at 75°F. or above. This has been done for two consecutive years with only a small percentage of hibernation. The total egg yield was more than 630,000 in 1931 and 1,413,000 in 1932 up to 1st December. Moth production in 1932 up to 1st December was 141,421.

Optimum air conditions for *M. ancylivora* were found to be 65–75°F. for oviposition and 70–80°F. for mating, with 40–80 per cent. relative humidity. Experiments indicate that females placed in a cage on emergence from the cocoon with an equal number of males are not always satisfactory for production, and that those mated with an excess of males give better results. A single female will parasitise 10–15 larvae in the course of 24 hours at the height of her oviposition period, after which the daily rate declines. To obtain second or third instar larvae for parasitism, 2,000–4,000 eggs of *C. molesta* were placed daily on green apples sliced in a pan and kept for 4 or 5 days at 80°F. These slices were then hung in the parasite cage about 1 inch from the top, and the adults of *M. ancylivora* were introduced daily. The parasitised larvae were removed and kept in the breeding room at 75°F. or above. Fresh apples were added after several days to accommodate larvae leaving the original slices, and corrugated paper strips were provided for spinning and pupation. These strips were subsequently removed and kept for emergence or placed in hibernation. The problem of successfully carrying parasitised material into hibernation has not yet been solved. It is known that larvae of *M. ancylivora* that survive the winter do so in the first instar. As it has been stated that unhatched eggs may be destroyed by the host, it is probably necessary to allow maximum numbers of larvae to hatch and then to lower the temperature gradually. By continuous breeding in winter and spring, however, it was possible to obtain a surplus of 7,500 in June, the total number of adult parasites reared during the year being 37,000. A careful watch must be kept for ants or other enemies, and control measures should be be applied as soon as they appear near the breeding cages.

Frost (S. W.). **Summer Oil Emulsions against the Oriental Fruit Moth and other Insects.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 334–344, 1 pl., 1 ref. Geneva, N.Y., April 1933.

Laboratory tests with 2 per cent. oil emulsions, carried out in Pennsylvania in 1932 in continuation of experiments in the control of the oriental fruit moth [*Cydia molesta*, Busck] previously noticed

[*R.A.E.*, A, xx, 425], gave a kill of only 50 per cent. or less of the newly-hatched larvae when the eggs were attached to the actual foliage of peaches after the spray had been applied instead of to the glass slides used in the former tests. Although the results obtained in 1932 indicate that 1 and 2 per cent. oil emulsions give a comparatively low rate of mortality of the newly-hatched larvae, there is no doubt that oil emulsions sprayed directly on the eggs will give a high percentage of kill. Tests against the summer eggs of *Eulia velutinana*, Wlk., with a 2 per cent. oil emulsion, in which small pieces of cellophane bearing batches of eggs were fastened to a board and sprayed, gave 100 per cent. mortality. The application of 1 and 2 per cent. Verdol against *Paratetranychus pilosus*, C. & F., on branches of apple gave 99·8 and 99 per cent. mortality respectively. Several commercial oil emulsions have been used without injury on peach and apple, as have the same oils in combination with sulphur on peach and with 3–3–50 Bordeaux mixture on apple.

No control of codling moth [*Cydia pomonella*, L.] on apple was obtained with 2 per cent. oil emulsions without lead arsenate. A dust of sulphur, lead arsenate and lime impregnated with 5 per cent. oil caused marked reduction of infestation of peaches by *C. molesta*. Although considerable defoliation, possibly due to the application of too much material to a tree, was observed at picking time, no injury was evident where sulphur-lime or sulphur-oil dusts were applied, but these dusts gave less control of *C. molesta*. Fruit injury consisting of surface cracks observed in all the dusted plots, which were treated six times, about 1 lb. of dust being applied to each tree, may also have been due to excessive applications.

PHIPPS (C. R.) & DIRKS (C. O.). **Dispersal of the Apple Maggot.—1932 Studies.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 344–349, 1 pl., 1 fig., 1 ref. Geneva, N.Y., April 1933.

The studies of the dispersal of *Rhagoletis pomonella*, Walsh, carried out in Maine in 1931 [*R.A.E.*, A, xx, 517] were repeated in 1932 in a different release area, but using the same technique, except that flies of known age were used. Of 3,152 flies released in one site, 130 were recovered at distances varying from 65 to 233 yards. About half the flies, marked with green enamel, were released on 25th July and the remainder, marked with silver enamel, on 27th July. Although released in unsprayed trees bearing many apples, the marked flies soon left them as they did unsprayed non-bearing trees in the 1931 tests. Marked flies were taken almost daily from 1st to 29th August. The area under observation in 1932 was much more extensive than in 1931, and the number of trees to be searched was greater. The proportion of flies recovered was slightly more than 4 per cent. of the number released, as compared with 11·8 per cent. in 1931. Of the flies recovered in 1932, 54 per cent. were taken 122–148 yards, 40 per cent. 156–183 yards and 3 per cent. 212–233 yards from the point of release. In contrast to 1931, when the percentage of females was relatively small, 44 per cent. of the flies recovered were female. As most of the flies taken were 4–5 weeks old, it is concluded that they are not injured by marking. The first female observed mating was 15 days old and the last 35 days old.

None of the marked flies released at different times in various parts of a young sprayed orchard were recovered. Although some of these

may have been poisoned, it is probable that lack of adequate shelter or scarcity of fruit caused them to disperse widely.

The results secured in 1932 indicate that dispersal is not necessarily a gradual process, as suggested in 1931, many of the marked flies having crossed open fields to trees about 125 yards away. The fact that in both years flies were recovered on trees situated in practically every direction from the release point indicates that over a period of several weeks they tend to disperse rather widely. Although the distances travelled in 1932 were somewhat greater than in 1931, it is still considered that the removal of all neglected apple and wild hawthorn [*Crataegus*] trees within 200 yards of commercial plantings will largely prevent infestation from outside the orchard.

Phipps (C. R.) & Dirks (C. O.). **Notes on the Biology of the Apple Maggot.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 349–358, 2 pls., 5 graphs, 4 refs. Geneva, N.Y., April 1933.

Rhagoletis pomonella, Walsh, was the chief insect pest of apple in Maine in 1932, when an unusually large proportion of the late fruit was attacked. For investigating the life-history, a concentrating trap was devised in which the larvae emerging from a known variety and number of fruits fall through a wire screen into a tray and so can be accurately counted. The larvae are transferred, after counting, to bottomless overwintering boxes buried in the ground. Screen-covered cages are subsequently placed over these boxes to catch the flies when they emerge. Fairly exact figures can thus be obtained showing the influence of various factors on numbers and survival of larvae, percentages of two-year cycle and second generation flies, etc.

The data obtained in 1931 and 1932 by this means indicate that larval survival and the time of fly-emergence are affected by the variety of fruit in which the larvae develop. Light soil favours the winter survival of pupae and the early emergence of flies. A small autumn or second brood of flies has been produced in the cages each year in one section of the State, but not in others where the soil is heavier. Only larvae that develop in early or summer varieties transform to flies in the same season. Practically all these flies appear during the first two weeks in October and are not of economic importance. Cages established in two localities in 1930 yielded a few two-year cycle flies in 1932, representing 8·5 and 5·2 per cent. of the total number that had previously appeared as one-year cycle adults. In both places the two-year flies appeared at the height of the regular one-year emergence. It is possible that some of the flies may spend three or more winters in the pupal stage.

Daily sex records of nearly 32,000 flies in 1932 indicate that the females emerge earlier and that the period during which the two sexes emerge in nearly equal numbers coincides with the peak of emergence.

Parrott (P. J.). **The Codling Moth in New York.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 358–363. Geneva, N.Y., April 1933.

During the past three years, *Cydia* (*Carpocapsa*) *pomonella*, L., has caused exceptionally severe injury in many apple orchards in western New York, damage in neglected or poorly sprayed orchards amounting

to 50–80 per cent. of the fruit. In one sprayed orchard the injury averaged about 4 per cent. over a period of 10 years, but amounted to 23 per cent. in 1931, consisting mainly of "stings." Although actual financial loss from this type of injury has not been large, such a development is significant and requires further study. In 1932, when infestation by *C. pomonella* was the heaviest experienced for 35 years, tests with a number of spray mixtures showed an efficiency varying from 90 to 95 per cent. Owing to the surprisingly small differences in effectiveness, no suggestions can be made for a change in the existing system of treatment, although the need for improvement is admitted. The situation can apparently only be met by a decisive alteration in the economic position of the growers, enabling them to place spraying on a higher plane and to adopt more generally supplementary practices concerned with the improvement of the external appearance of the fruit preparatory to marketing.

FARRAR (M. D.) & FLINT (W. P.). **Chemically treated Bands.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 364–373, 1 graph, 6 refs. Geneva, N.Y., April 1933.

Experience in the use of chemically treated bands for controlling the larvae of *Cydia* (*Carpocapsa*) *pomonella*, L., has shown that it is impossible to avoid wide variations in the efficiency of bands dipped in hot materials, owing to the difficulty in practice of regulating the dipping temperatures and consequently the amount and uniformity of the deposit. Results obtained over a 5-year period in Illinois have demonstrated that a cold-dipped, corrugated paper band, treated with 1 lb. powdered beta-naphthol, 1½ U.S. pints 200–300 seconds viscosity oil and 1 U.S. pint petrol, is as efficient in killing the larvae as is the hot-treated band. The cold-dipped band is preferable owing to uniformity of deposit, practical elimination of fire hazard, and ease of preparation. The incorporation of 9 per cent. liquid roofing cement in the cold mixture increased the catch by 31 per cent. and the kill by 36 per cent. Commercially ground beta-naphthol and oil proved a practical and efficient mixture for use in either hot or cold bands. The deposit on the bands with the cold treatment is adhesive and continuously effective throughout the season. Crude beta-naphthol has given as good a kill of larvae as the refined product, and its use may cheapen the cost of preparing treated bands. In the tests carried out in 1932 in Illinois, 4-inch bands collected 1·9 more larvae to the inch than 2-inch bands, and in a series of tests during the past 5 years the wider bands have caught a larger number of larvae in all cases.

In the discussion that followed, one of the authors (Flint) stated that a detailed examination of banded trees in an orchard about to be cut down showed that the larvae found under the bands represented 76 per cent. of the larval population of the trees. In another old orchard in Illinois an average of 6 larvae to the linear inch was found under the bands, the emergence from them being less than 1 per cent. over the entire season and 1,500,000 larvae being killed. Other workers quoted results obtained by them with bands in other localities, the estimated percentages of larvae taken being lower than those obtained by the authors. The method of dipping the bands in the cold mixture is discussed.

List (G. M.). **The net Gain during the last Decade in Codling Moth Control Information as indicated by Experience under Conditions especially favourable to the Insect.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 373–377. Geneva, N.Y., April 1933.

Conclusions arrived at from tests carried out in the control of *Cydia* (*Carpocapsa*) *pomonella*, L., and the experience of apple growers in Colorado, where conditions affecting the moth are extremely varied, are briefly summarised. The following is taken from the author's abstract : The true value of control suggestions can be most rapidly determined where conditions are extremely favourable to *C. pomonella*. The proper use of lead arsenate remains the most effective single control. Oil sprays in themselves are not satisfactory, but are of value in certain combinations. They complicate the spray residue problem and under many conditions are injurious to the fruit. Bait traps, as a means of timing the application of sprays, and chemically treated bands are two of the most important recent developments. Liberations of the egg parasite, *Trichogramma minutum*, Riley, have not shown definite control under Colorado conditions. Unless control measures can be improved, several areas will remain where apple growing cannot be profitably conducted.

Cutright (C. R.) & Houser (J. S.). **Experimental Results in Codling Moth Control with late Summer Oil Applications.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 380–383. Geneva, N.Y., April 1933.

Experimental work has been carried out for a number of years against *Cydia* (*Carpocapsa*) *pomonella*, L., in Ohio, on the effect of substituting summer oils alone for lead arsenate sprays applied late in the season, in the hope of avoiding the problem of excessive arsenical residues. Tests carried out from 1930 to 1932, however, showed that refined oil sprays applied at midsummer are not so effective as lead arsenate applied at the same time. Fewer entrances than " stings " were found in the apples treated with lead arsenate and fewer " stings " than entrances in those treated with oil, but the entrances caused much more serious injury, and the total injury was higher on the oil-sprayed plots. The trend of results in experiments in which nicotine sulphate was added to the oil slightly favours lead arsenate, but the differences are very small. As the use of oil at midsummer has proved quite effective in lowering arsenical residues, small growers lacking washing equipment will probably use it for late season control, whereas larger acreages will warrant an investment in washing machinery so that lead arsenate can be used throughout. In no instance during the tests have harmful arsenical residues resulted when lead arsenate was used in the calyx and first cover sprays and oil in the late-season sprays.

Sherman III (F.). **A Summary of Three Years' Experiments on the Control of Codling Moth in southwestern Michigan.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 383–392, 2 refs. Geneva, N.Y., April 1933.

Weather conditions during the three past seasons in Michigan have so accentuated the increase of *Cydia* (*Carpocapsa*) *pomonella*, L., that control has become a serious problem. Tests carried out from 1930 to 1932, some of which have already been noticed [*R.A.E.*, A, xx, 34], have shown that lead arsenate, 2 per cent. summer oil, and a combination of 1 per cent. summer oil and nicotine sulphate ($\frac{3}{4}$ pint to 100 gals.) will

give good control in heavily infested orchards. Successful control with lead arsenate sprays throughout the season involved the removal of excessive arsenical residues from the fruit, whereas the use of non-arsenicals in the summer sprays kept the residues in most cases within the limits of tolerance. Bait traps for the moths were found valuable for timing cover sprays and for determining the necessary number of summer brood sprays. Even intensive spraying, however, failed to give satisfactory control unless preceded by scraping and banding of the trees. An orchard that had received the standard lead arsenate treatment only, without scraping and banding, showed an infestation (including " stings ") of 35–40 per cent.

Cutright (C. R.) & Dietz (H. F.). **The Technique of Codling Moth Field Experiments.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 392–401, 3 figs. Geneva, N.Y., April 1933.

The principles that should govern the planning of field experiments in the control of *Cydia* (*Carpocapsa*) *pomonella*, L., are discussed in detail. In the course of three seasons' experience in which the results obtained from large plots were compared with those obtained from duplicated single-tree or small plots, it was found that the latter system possessed decided advantages. Apart from the saving in time and labour, the small plot permits the increased use of duplications, desirable plot arrangements and a more complete collection and analysis of pertinent data, which are precluded by the use of large plots. The proper size of the plots and their arrangement in random blocks are considered to be of major importance. The equipment necessary for handling efficiently such an experiment is discussed, together with methods of sampling, and the collection and final analysis of data. Satisfactory analysis depends on the accuracy of the samples taken. Both fallen and picked apples must be sampled, and the relation of these samples to each other and to the total amounts of fallen and picked fruit must be determined. The most satisfactory method of recording injury is to count all individual entrances and " stings," and also to combine the separate records so as to obtain one representative figure. If time is short, however, the greater differentiation obtained by this method is offset by the greater number of fruits that can be included in a given time if the injured fruit is taken as the unit. All the data collected in the field are assembled on a specially drawn up sheet in such a manner that they can be readily analysed. Where single tree plots are used, these data sheets give a record of the performance of any individual tree from year to year.

Schread (J. C.). **Methods of breeding *Trichogramma* in Connecticut.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 402–404, 1 pl. Geneva, N.Y., April 1933.

Sitotroga cerealella, Ol., a common laboratory host of *Trichogramma* [*minutum*, Riley] is reared in Connecticut on red winter wheat, which has proved a much more satisfactory medium than maize. The moths begin to emerge sooner from wheat than from maize and yield nearly 8 times as many eggs, far greater numbers being obtained of all generations. Each cage is composed of a rearing compartment, 14×26×14 inches, and an extracting compartment, 10×26×14 inches, fastened together side by side. Each compartment consists of a white-pine frame, the top and bottom of which are covered on the inside

with tin, and the back and exposed side with 30-mesh copper netting. The rearing compartment contains 12 trays with a $\frac{5}{16}$ inch aperture between each for moth extraction. The front of the rearing compartment is closed with a 30-mesh copper netting door, whereas a funnel made by moulding a sheet of tin extends from the front of the extracting compartment. The top of the funnel is made of celluloid, tacked and reinforced with celluloid cement. The most satisfactory results were obtained with 3½ lb. wheat to a tray, which produced more moths than 4½ lb. The seasonal egg production increased from 18,640,000 in 11 months of 1930 when 73 per cent. of the kernels produced moths, to 38,972,000 in 8 months of 1932, when 92 per cent. were productive.

The cages with traps of wheat are sterilised in the rearing room for 2 days by means of gas stoves at a temperature of 140–160°F. The rearing room, which is heated by steam pipes and humidified by wetting the floor, is then maintained at rearing conditions of 80–85°F. and 60–70 per cent. humidity for one week, after which the wheat is inoculated with 60,000 eggs of *S. cerealella* to a cage. Rearing progresses for two months before the live moths are extracted, by means of a strong draught from a portable blower. The air is directed first from the side of the rearing compartment into the apertures between the trays, and then from the back of the extracting compartment, so that the moths are blown into an oviposition tin fastened to the end of the funnel. This is made by replacing the bottom of a coffee tin with 30-mesh strainer cloth and soldering three ¼-inch stilts to the lower edges. The moths are admitted through a hole in the lid, which is afterwards corked. The tins receive not more than ¾ inch of moths each and are kept on trays in an incubator. They are tapped gently once in 24 hours for 3 days, to dislodge the eggs that do not fall through the 30-mesh strainer cloth into the trays. Eggs for parasitism are fastened with white shellac to cardboard disks, 8,000–9,000 to a disk. While awaiting parasitism, the egg cards are refrigerated at 38°F. and 60 per cent. humidity.

Bevelled watch-glasses, 2½ inches in diameter, ground together in pairs, are used as oviposition units for *T. minutum*. Stock cards of *Sitotroga* eggs are divided into sections, inserted in the watch-glasses and placed in a dark incubator until the parasites begin to emerge. They are then exposed to light from below in a specially constructed incubator, capable of accommodating 1,500,000 parasites at one time, which is described, where they complete emergence in a few hours. The egg cards are exposed to the parasites with the egg surface of the card downwards, in contact with the bottom of the watch-glass, where they receive complete illumination. After 3–4 days the parasitised eggs are removed from the incubator to the refrigerator or the field. The yearly production of *T. minutum* increased from 16,216,000 in 1930 to 22,320,000 in 1932.

WORTHLEY (L. H.) & STOCKWELL (C. W.). **Economic Status of the Japanese Beetle in 1932.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 405–410. Geneva, N.Y., April 1933.

The following is substantially the authors' abstract: In 1932 *Popillia japonica*, Newm., probably caused greater destruction of fruit and produce crops than in any year since its discovery in the United States in 1916. Initial infestations in or near classified nurseries were discovered in 163 cases in 1932 as compared with 126 in 1931. Traps

distributed in cities and towns outside known infested territory resulted in the discovery of a large number of first record infestations at points more remote from the densely infested zone than any heretofore found infested. This does not necessarily indicate a greater spread of *P. japonica* in 1932 than in any previous year, but demonstrated that scouting with traps is more efficient than visual scouting by temporarily employed scouts. Surveys of southern New Jersey, south-eastern Pennsylvania and northern Delaware sections most heavily infested by the beetle disclosed that from 75 to 100 per cent. defoliation of preferred food-plants took place over an area of 1,647 square miles, that foliage damage of 50–75 per cent. was evident in 1,378 square miles, and that evidence of at least 25 per cent. foliage injury was observed over an additional area of 1,353 square miles.

METZGER (F. W.). **Preliminary Tests with liquid Bait in Japanese Beetle Traps.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 411–414, 1 pl., 1 ref. Geneva, N.Y., April 1933.

In an attempt to devise a method of exposure of geraniol and eugenol in traps for *Popillia japonica*, Newm. [*R.A.E.*, A, xvii, 421] that would make them of constant maximum attractiveness to the beetle over a period of several weeks, these substances were placed in small bottles and vaporised by means of wicks. The wick employed is of cotton, $\frac{3}{16}$ to $\frac{1}{4}$ inch in diameter, the inner fibres running lengthwise and covered on the outside with a woven cotton sheath. This was inserted through a cork into a 1 oz. bottle, and the portion of the wick within the bottle was without a sheath. Geraniol was used at the rate of 10 parts to 1 of eugenol, the bottle being filled at the beginning of the test. Tests with liquid bait in standard traps indicated that the greatest increase in catch over that from neighbouring traps containing standard bait occurred when a 4-inch wick was employed, the difference in favour of the liquid bait being 26·8 per cent. The attractants were vaporised at an average rate of 2·2 gm. per trap per day during 8 days in the field. Volatilisation was slower with shorter wicks, and the number of beetles caught was correspondingly smaller.

In a second series of tests the trap used was of a type in which the cylinder was eliminated by attaching a jar to the bottom of the funnel and placing the bait in a 6-inch shuttered container fixed in the baffle. Standard bait used in this type of trap gave an increase in catch of 17·5 per cent. over the cylinder type, and liquid bait used with a 5-inch sheathed wick produced an increase of 30·7 per cent., leaving a net increase of 13·2 per cent. in favour of liquid bait over the bran-molasses mixture. The average amount of geraniol and eugenol vaporised per trap per day from 5-inch wicks in traps without cylinders was 0·55 gm. as compared with 1·07 gm. from the 2-inch wick in the cylinder trap in the first series, whereas the difference in the number of beetles captured was 6·6 per cent. in favour of the former. The greater amount of the attractants vaporised by the shorter wick is accounted for by the fact that the temperature inside the cylinder was several degrees higher than that in the shuttered container. Over a period of 4 weeks a 5-inch wick shutter-type container dispensed 16 gm. of geraniol and eugenol at a cost of approximately 2½d., or less than one-third the cost of maintaining a standard bait trap replenished fortnightly. A 4-inch wick in a trap where the liquid bait was placed in the cylinder used 61·6 gm. of the attractants at a cost of 11½d., or

considerably more than the regular bait for a similar period. The wicking is comparatively inexpensive, and the bottles and corks would probably last over several seasons.

HAMMER (O. H.). **Further Studies on the Control of the Apple Curculio in the Champlain Valley.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 420–424, 1 pl. Geneva, N.Y., April 1933.

Life history studies of *Tachypterellus quadrigibbus*, Say, in eastern New York [*R.A.E.*, A, xx, 516] were continued in 1932. The weevils became active shortly before the middle of May, and each phase of development was a few days later than in 1931, oviposition beginning on 1st June. Examination of apples at picking time showed that many contained live adults, some of which had eaten tunnels from their pupal chambers to the surface of the apple and had only to break the skin in order to escape. Others would probably never have escaped, as they were feeding towards the core. A careful search was made for hibernating weevils in many situations in and adjoining orchards, but they were only found in débris, etc., directly under the trees. The destruction of apples that fell from the trees in June 1931 did not appear to effect any great reduction in the infestation for 1932. Such apples should be collected on at least two occasions, but the fact that many of the beetles emerge from the fruit on the trees lowers the efficiency of this method of control. The results of spraying with lead arsenate were not as encouraging as in 1931. Of a number of other materials used in preliminary tests, cryolite gave the most promise.

FELT (E. P.). **Notes on new or little known Scale Insects.**—*J. Econ. Ent.*, xxvi, no. 2, p. 424. Geneva, N.Y., April 1933.

Lecanium excrescens, Ferris, which is recorded for the first time from the eastern United States, was found in May 1932 on *Wisteria*, and *Aspidiotus tsugae*, Marl., was observed in considerable numbers on yew (*Taxus*), both in Connecticut. *Lepidosaphes newsteadi*, Sulc, was discovered on umbrella pine [*Sciadopitys*], which has not hitherto been known to be subject to insect attack, in sufficient numbers materially to check the vigour of the tree. An examination showed the scales to be numerous at the base of the needles and on adjacent wood, where they occurred in clusters of 3–8.

HUTSON (R.). **Experiments on the Control of Mites infesting Raspberries.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 425–430, 3 refs. Geneva, N.Y., April 1933.

Tetranychus mcdanieli, McGregor, has been found to be mainly responsible for the damage caused by spinning mites to red raspberries for several years past in the extreme south-west of Michigan [*R.A.E.*, A, xx, 85]. *T. telarius*, L. (*bimaculatus*, Harv.) and *Paratetranychus ilicis*, McGregor, previously reported from South Carolina on holly (*Ilex opaca*), were also present in smaller numbers. Characters distinguishing *T. mcdanieli* from *T. telarius*, which it closely resembles, are given. In addition to injury previously noticed [*loc. cit.*], the normal growth of the young shoots producing the following year's crop is impaired, no leaves being left on them by 1st August except tufts at the tips.

T. mcdanieli, which was shown by microscopic examination of raspberry canes to be present during January and February 1931 beneath

the scales about the buds and under loose strips of bark, does not appear to winter in rubbish on the ground among the canes. The mites are present on raspberry foliage as soon as the buds show green. Plantings on dry soils suffer more severely. All three species of mites occur on sow-thistle (*Sonchus arvensis*) in infested raspberry plantations. *T. mcdanieli* becomes extremely abundant on old canes after harvest and migrates to young ones in search of suitable food.

Single applications in April of dormant and summer oils, glue, and contact poisons of plant origin were not effective enough to prevent severe infestation in May. Sprays containing sulphur cannot be used as they cause severe injury to raspberry. A series of three sprays of summer oil at 1 per cent. strength reduced the mite population to an extremely low figure in May 1931, and an identical series of sprays applied just after the leaves came out in April and May 1932 protected raspberries from damage. Raspberry foliage is not apparently affected by 1 per cent. summer oils, which, however, fail to destroy the eggs of *T. mcdanieli*.

Glasgow (H.). **The Host Relations of our Cherry Fruit Flies.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 431–438, 2 pls., 1 ref. Geneva, N.Y., April 1933.

The following is the author's abstract : In the eastern United States the cherry fruit-flies, *Rhagoletis fausta*, O.S., and *R. cingulata*, Lw., have been found to breed freely in certain native wild cherries, particularly in the common black cherry (*Prunus serotina*) and the native bird or fire cherry (*P. pennsylvanica*). In this region *P. serotina* seems to be the principal native host for *R. cingulata*, whereas *R. fausta* is confined chiefly to *P. pennsylvanica*. These two fruit-flies are not well adapted to the native choke cherry (*P. virginiana*), and this fruit appears to be of little importance as a food-plant for either species.

Siegler (E. H.) & Munger (F.). **A Field and Laboratory Technique for toxicological Studies of the Codling Moth.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 438–445, 2 pls., 1 fig., 1 ref. Geneva, N.Y., April 1933.

In order to minimise certain difficulties experienced in insecticide tests against the codling moth [*Cydia pomonella*, L.], a method has been devised whereby small plugs of apple, cut from sprayed fruit in the field or uniformly sprayed with the insecticide under test are sealed in glass cylinders. One egg of *C. pomonella* is confined with each plug and, upon hatching, the larva encounters the insecticide as it attempts to gnaw its way through the skin of the fruit. The disadvantages of field and laboratory methods in general use are summarised, and details are given of the technique and of the materials required for making the tests. The percentage of larval entrances in unsprayed fruit as shown by this method was never less than 94. In fruit sprayed with lead arsenate at varying strengths, it ranged from 47·1 with a concentration of 1 lb. to 50 U.S. gals. to 6·7 with one of 5 lb.

Herrick (G. W.) & Griswold (G. H.). **Naphthalene as a Fumigant for the immature Stages of Clothes Moths and Carpet Beetles.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 446–451. Geneva, N.Y., April 1933.

In continuation of work with fumigants against the immature stages of clothes moths and carpet beetles [*R.A.E.*, A, xx, 416], naphthalene

was used in a series of tests extending over a period of several months in 1932. It was applied in a galvanised iron box or a more or less air-tight trunk, each having a capacity of 5 cu. ft. and being two-thirds full of clothing, in which pasteboard cartons containing the insects were wrapped. Naphthalene flakes at the rate of 2–3 oz. proved toxic to the eggs and larvae of *Tineola bisselliella*, Humm., when confined for a sufficient length of time in the trunk or box. Moth balls at the rate of 8 oz. proved toxic to the larvae when confined in the box for 3–4 weeks. The flakes, when scattered loosely among clothing, appear somewhat more effective than the moth balls, and can be prevented from adhering to garments by being scattered between layers of newspaper.

The larvae of *Attagenus piceus*, Ol. (black carpet beetle) are more resistant to naphthalene than are those of the clothes moth. When 3 oz. of flakes were placed in a shallow tin on the top of the clothes and allowed to remain for 3 weeks in the box, only one larva out of 40 was killed. When the flakes were loosely scattered among the clothing, however, 49 out of 55 larvae were killed. No better results were obtained with 8 oz. of the flakes than with 3 oz. The larvae of *Anthrenus verbasci*, L., proved even more resistant to naphthalene, but fumigated larvae, although not killed, were less active and caused less damage than unfumigated ones.

JONES (H. A.), GERSDORFF (W. A.), GOODEN (E. L.), CAMPBELL (F. L.) & SULLIVAN (W. N.). **Loss in Toxicity of Deposits of Rotenone and related Materials exposed to Light.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 451–470, 4 diagr., 14 refs. Geneva, N.Y., April 1933.

The following is the authors' abstract. Rotenone, dihydrorotenone, rotenone hydrochloride, rotenone-bentonite (1 : 1), rotenone-lampblack (1 : 1), ground derris root, and powdered derris extract were each made into a paste with water and painted heavily on weighed glass slides. After the deposits had dried, the slides were weighed again. One group of slides was exposed to direct sunlight for 10 days during April and May, a second group to sunlight for 20 days, a third group to arc-light for 240 hours, a fourth group, of the three pure compounds only, to arc-light for 480 hours, and a fifth group was kept in the dark at room temperatures.

The deposits on these slides were tested against Culicine mosquito larvae and goldfish to determine the percentage of loss of toxicity resulting from the exposure to light. In all cases the exposed deposits were decidedly less toxic than the unexposed and, with one exception, the loss of toxicity increased with increasing exposures. Rotenone, rotenone-bentonite, derris root, derris extract and rotenone hydrochloride lost more than half of their toxicity during 10 days' exposure to sunlight. Their toxicity was practically destroyed by the exposure to arc-light.

Since dihydrorotenone lost only one-fourth to one-third of its toxicity during the first ten days' exposure to sunlight, it was distinctly more resistant to detoxication during this period than rotenone. However, at the end of twenty days in sunlight and after exposure to arc-light it had lost its toxicity to about the same extent as rotenone. Lampblack markedly reduced the loss of toxicity of rotenone during the first 10 days' exposure to sunlight, and prevented further loss during the second 10 days. It also gave some protection to rotenone under arc-light. Neither bentonite nor the substances occurring with rotenone in powdered derris root and derris extract protected rotenone from loss of

toxicity. The unexposed powdered derris root, containing about 25 per cent. rotenone, was as toxic to mosquito larvae as pure rotenone. It was shown that the photochemical decomposition of dry rotenone, which results in loss of its toxicity to insects and fish, does not take place in the absence of oxygen.

HOUGH (W. S.). **The Efficiency of Tar Distillate Sprays in controlling San José Scale in 1932.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 470–473, 1 ref. Geneva, N.Y., April 1933.

A second season's experiments in Virginia with sprays containing tar distillates against *Aspidiotus perniciosus*, Comst., on apple confirmed the results of 1931 [*R.A.E.*, A, xx, 520]. In 1932 three tar distillates of English and four of American origin were used, specifications being given in the case of the latter. The following is a convenient formula for making tar distillate emulsions: 3 U.S. gals. tar oil, 1 U.S. gal. petroleum (lubricating) oil, and 2 U.S. gals water and sodium caseinate. The sodium caseinate is prepared by dissolving about 7 oz. powdered casein in ½ U.S. gal. boiling water in which about 1½ oz. sodium metasilicate had been dissolved, and diluting to 2 U.S. gals. The petroleum oil, which facilitates emulsification of the tar oil, is next added and the mixture pumped through the nozzle until emulsified. As the mixture is pumped back on itself, tar oil is gradually added and pumping continued until emulsification is completed, resulting in a stock of 50 per cent. tar oil. No evidence of serious injury to apple trees has appeared following the use of tar oils in the dormant season, though bud development is sometimes slightly delayed. The experiments indicated that only the higher concentrations of the sprays give control of *A. perniciosus* comparable with that obtained with a standard petroleum oil spray of 3 per cent. oil, which usually effects a mortality of over 95 per cent. Experience of the past two seasons has shown, however, that 2¾ per cent. tar oil is sufficient to give 100 per cent. kill of Aphids in the egg stage. Where both Aphids and scale are to be controlled in the dormant season, a combination is therefore suggested of sufficient tar oil to kill the Aphid eggs and sufficient petroleum oil for the adequate control of *A. perniciosus*.

HARTZELL (F. Z.), PARROTT (P. J.) & HARMAN (S. W.). **Experiments with Tar Distillate Sprays against Fruit Aphids and associated Insects.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 474–480, 2 refs. Geneva, N.Y., April 1933.

In continued experiments with tar distillate sprays in New York [*cf. R.A.E.*, A, xix, 360; xx, 520], field trials were conducted in a number of orchards in 1932 to determine the effect of 4 European and 4 American brands on several species of insects. The concentration used on apples generally varied from 5 to 7½ per cent., although 2 and 3 per cent. sprays were tried on a few trees. Except in the case of one plot that was sprayed very late in the autumn, all applications on apple were made in the spring and not later than the grey-tip stage of the buds. On sweet cherry (against *Myzus cerasi*, L.) and pear (against *Psylla pyricola*, Först.) the one brand tested was used at concentrations of 4 and 5 per cent. respectively.

Control of *Anuraphis roseus*, Bak., was secured in all trials when the concentrations of the tar washes were not less than 5 per cent. Lower concentrations generally proved less effective. An autumn application

did not give as high control as spring treatment. At not less than 5 per cent. concentration, spring applications were as effective as a delayed dormant spray of nicotine sulphate (1 : 800). One year's test indicates that tar washes may prove very effective for preventing injury by *M. cerasi*. Tests with one brand indicate that in severe infestations tar distillate sprays are not so satisfactory as lubricating oil emulsions for the control of *Aspidiotus perniciosus*, Comst., but four brands used at 5 and 7½ per cent. concentrations, appeared to be very effective against *Lepidosaphes ulmi*, L. Against *Eucosma* (*Spilonota*) *ocelleana*, Schiff., 7½ per cent. tar washes proved only slightly inferior to nicotine sulphate (1 : 400) in lubricating oil ; low concentrations of the washes produced moderate control. The results with *Lygidea mendax*, Reut., indicate that rather low efficiencies are to be expected from tar washes (7½ per cent.). One brand proved destructive to the eggs of *P. pyricola*. At the concentrations used, none of the sprays injured the buds or wood of apple, sweet cherry and pear.

HARTZELL (F. Z.). **Tests with Tar Distillate Sprays for Foliage Applications.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 480–486. Geneva, N.Y., April 1933.

The following is substantially the author's abstract : Tar distillates were tested as foliage sprays on numerous varieties of apples in New York during 1932 to determine their value for the control of *Cydia* (*Carpocapsa*) *pomonella*, L., and *Aphis pomi*, DeG. Four brands were used at the rate of 0·75 per cent. with each of the following fungicides : lime-sulphur (1 : 40), Bordeaux mixture (4 : 8 : 100) and sulphur-lime dry-mix (25 lb. in 100 U.S. gals. spray). The tar washes were found to be compatible with each of the fungicides, and in some instances the addition of the latter actually decreased leaf scorching when compared with the same brands used alone. The results against *A. pomi* were so irregular and contradictory that no conclusions could be drawn. Of 16 comparative tests in the control of *C. pomonella*, based on infested apples, lead arsenate in the same fungicides proved superior to the tar distillates in every one ; it also gave better control in 15 of the 16 pairs of tests when the total injuries were considered. The problem of spray residue was not eliminated. Leaf injury, russeting and pitting of the fruit on a number of varieties lead to the conclusion that the causes of these injuries must be determined and eliminated before much progress can be made in experimentation with tar distillate sprays for the control of *C. pomonella*.

RICHARDSON (C. H.) & THURBER (G. A.). **Further Studies on the relative Toxicity of Poisons for Grasshopper Baits.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 494–499, 13 refs. Geneva, N.Y., April 1933.

An investigation begun in 1931 for the purpose of finding a substitute for arsenious oxide in grasshopper baits, either because it is more toxic to grasshoppers, has a lower toxicity to vertebrate animals, is available at reduced cost, or has some other advantageous property [*R.A.E.*, A, xx, 695], was continued in Iowa in 1932.

The following is the author's abstract : Adults of *Melanoplus differentialis*, Thomas, were fed determined quantities of a standard bran-molasses bait which contained known concentrations of arsenious oxide, sodium fluoride, cuprous cyanide, zinc phosphide, sodium fluoaluminate (cryolite), acid lead arsenate and nicotine tannate. The

method is described. The estimated median lethal dose (M.L.D.) of the first three compounds is 0·11 mgm. per gm. of body weight ; for zinc phosphide it is 0·52 mg. Acid lead arsenate is much less toxic, the M.L.D. being apparently between 2 and 4 mg. ; sodium fluoaluminate is evidently less toxic than acid lead arsenate. Nicotine tannate has a low but undetermined toxicity for this insect. The toxicity of some of these compounds for other insects is discussed briefly from the literature. Cuprous cyanide and zinc phosphide seem worthy of further experimental investigation.

Campbell (F. L.), Sullivan (W. N.) & Smith (C. R.). **The relative Toxicity of Nicotine, Anabasine, Methyl Anabasine and Lupinine for Culicine Mosquito Larvae.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 500–509, 1 graph, 6 refs. Geneva, N.Y., April 1933.

An account is given of experiments, using Culicine larvae as the test insects, to compare the toxicities of certain alkaloids related to nicotine, namely anabasine, methyl anabasine and lupinine. These alkaloids were prepared from a commercial sample of " anabasine sulphate, 40 per cent.", obtained from a Russian weed *Anabasis aphylla*, which is identical, except in optical activity, with synthetic neonicotine [*R.A.E.*, A, xix, 100 ; xx, 37].

The following is the authors' abstract : Based on the concentration required to kill 50 per cent. of a population of Culicine mosquito larvae in 8 hours at 29·3°C. [84·74°F.], the relative toxicity of the four alkaloids is as follows : nicotine 100, anabasine 38, methyl anabasine 21, and lupinine 6 (?). According to the unpublished observations of other workers, nicotine and anabasine may be equally effective against Aphids. Nicotine and anabasine are much less toxic than rotenone against mosquito larvae and house-flies. Methods for preparing the alkaloids and for obtaining, rearing, counting and transferring mosquito larvae are described.

Cutright (C. R.). **Injury to Carrot,** *Daucus carota*, **by** *Trifidaphis phaseoli* **(Pass.).**—*J. Econ. Ent.*, xxvi, no. 2, p. 509. Geneva, N.Y., April 1933.

Trifidaphis phaseoli, Pass., has been collected several times in the past two years from carrots in the hill sections of the upper Ohio Valley. In the course of working with subterranean Aphids in this region in 1923–25, *T. phaseoli*, although collected from a number of food-plants, was not found on carrot. The presence of even a few Aphids causes severe injury to the roots, on the sides of which large depressions occur. If the infestation is about the growing tip, normal growth is stopped and several branching, almost fibrous, roots may be produced.

Keifer (H. H.). **The Lesser Apple Worm** (*Grapholitha prunivora* **Walsh) in California.**—*J. Econ. Ent.*, xxvi, no. 2, p. 509. Geneva, N.Y., April 1933.

Several records are given of the occurrence in 1929 and 1930 of the larvae of *Enarmonia* (*Grapholitha*) *prunivora*, Walsh, in the fruits of wild rose and *Photinia*, and the subsequent appearance of the adults in the late summer and autumn in the northern part of California. *E. prunivora* is not known as an orchard pest in this State.

FLANDERS (S. E.). *Sitotroga* **Production.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 510–511. Geneva, N.Y., April 1933.

Over 12 million eggs of *Sitotroga* [*cerealella*, Ol.] were obtained in 5 months by the operation of a unit set up in a manner similar to that already noticed [*R.A.E.*, A, xix, 216] and holding $\frac{3}{8}$ ton maize. The maize was packed in 10 bins, each measuring $36 \times 30 \times 5$ inches. A tube $1\frac{1}{4}$ inches in diameter having a slot $\frac{1}{16}$ inch wide opening into the cloth enclosure was substituted for the funnel previously used [*loc. cit.*]. Connected in line with this tube was an electric hair-drier and a moth receptacle consisting of a one-gallon glass jar with a screw top. The moths leave the grain and concentrate on the cloth in areas where they are subjected to optimum pressure from a constant air current, which enters the enclosure through a slot $\frac{1}{4}$ inch in width extending along the top. In collecting the moths the air pressure is not cut off as previously suggested, but the operator strikes the cloth several times to dislodge the moths resting on its inner surface. These drop to the V-shaped bottom of the enclosure, slip through the slot into the suction tube and are carried to the moth receptacle. Collections are made once or twice daily, and after each of them, the jar is disconnected, closed by screwing on a 20-mesh screen cover and inverted over a trough for egg deposition. An air current from an electric fan carries away the scale dust.

SNAPP (O. I.) & THOMSON (J. R.). **Worn-out Motor Oil for the Control of the San José Scale.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 511–512. Geneva, N.Y., April 1933.

Tests carried out in Georgia during the winter of 1931–32 indicate that used oil from the crank cases of motor-cars will give very good control of San José scale [*Aspidiotus perniciosus*, Comst.] on peach trees, provided that it is completely emulsified and that the emulsion is fairly stable. Rather more calcium caseinate must be used than is required for the emulsification of new lubricating oil, and the oils should be diluted to a 4 per cent. strength. Observations made at fortnightly intervals until 23rd May revealed no injury to the trees from the use of these oils.

FULTON (B. B.). **Naphthalene for Midge Larvae in Tobacco Seed Beds.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 512–513. Geneva, N.Y., April 1933.

In North Carolina, tobacco seedbeds have been badly infested by small midges for the past two years. The larvae appear in early spring when the seeds are germinating and are sometimes so numerous that the soil is pulverised and the rooting of the seedlings affected. Large numbers of the larvae were killed in a bed covered with a cloth after flake naphthalene had been scattered on it, whereas in adjacent untreated beds they were numerous and active. In a test in which equal quantities of infested soil were placed in six gallon jars, on five of which various chemicals were scattered before they were covered with cheese-cloth for 13 days, the total numbers of midges emerging from the various jars were as follows: naphthalene 45, mercurous chloride 100, Sentene 248, barium fluosilicate 1021, paradichlorobenzene 689, control 795. Naphthalene appeared to be more toxic to the older larvae, and mercurous chloride to the younger ones. Naphthalene was applied to

young tobacco seedlings in cloth-covered jars at rates equivalent to $1\frac{1}{2}$, 3, 10 and 20 lb. to 100 sq. yds. In the two jars receiving the heavier dosages the plants died after several days, but in the other two jars most of them were living after the naphthalene had evaporated. In tobacco beds $1\frac{1}{2}$ lb. to 100 sq. yds. gave satisfactory control of the midge. Additional applications as the material evaporates may be necessary while the plants are still small. No injury has been reported from localities where large quantities of naphthalene have been applied during the past season.

JONES (T. H.). **Parasites reared from the Elm Leaf Beetle and the imported Willow Leaf Beetle.**—*J. Econ. Ent.*, xxvi, no. 2, p. 513. Geneva, N.Y., April 1933.

Adults of an undescribed species of *Tetrastichus* emerged in the laboratory from collections of larvae and pupae of *Galerucella luteola*, Müll. (*xanthomelaena*, Schr.) made in 1932 in several localities in the north-eastern United States. It appears that only the pre-pupae and pupae are attacked. Parasitism in three different collections varied from 10 to 47 per cent.

Of 100 pupae of *Plagiodera versicolora*, Laich., collected in Massachusetts on 17th August 1932, 69 were parasitised by the Pteromalid, *Schizonotus sieboldi*, Ratz., a European species possibly introduced with *P. versicolora* or some closely allied Chrysomelid. In a further collection of 100 pupae made on 14th September, 84 were parasitised, but adults of *S. sieboldi* issued from only 39, the parasites in the remaining 45 pupae having been attacked by a hyperparasite.

FLUKE (C. L.) & LILLY (J. H.). **Decay of Apple Tissue in Storage associated with Cherry Case Bearer Injury.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 513–514. Geneva, N.Y., April 1933.

In Wisconsin the encased larvae of *Coleophora pruniella*, Clem., though primarily foliage feeders, often attack the fruit of both cherry and apple, especially in the later instars. The eggs are sometimes deposited in considerable numbers on growing apples, but though the larvae hatching from them may puncture the cuticle, they cannot apparently develop to maturity, as apple tissue is not their normal food and they are usually unable to reach the leaves. Decayed areas appear in apples so infested when placed in storage, and it was observed that rot usually occurs around the small feeding areas of the older larvae. It is not known whether these larvae introduce a rot-producing organism directly or whether they only produce wounds that permit of the entrance of secondary organisms.

BLANTON (F. S.) & SPRUIJT (F. J.). **The Species of *Eumerus* on Long Island.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 514–515. Geneva, N.Y., April 1933.

Until 1927 the Syrphids known as lesser bulb-flies in the United States were all considered to be *Eumerus strigatus*, Fall., but recent work has revealed the existence of two other species, *E. tuberculatus*, Rond., and *E. narcissi*, Smith [*R.A.E.*, A, xvi, 434]. Specimens collected in Long Island during 1929–1932 were therefore identified, and observations were carried out in 1931 and 1932 in order to determine the relative abundance of the species under various conditions

in the field. *E. tuberculatus* was found to be far the most common under all conditions. *E. strigatus* was considerably more numerous at a bulb dump heap than in any other habitat, which suggests that it is more of a scavenger than the other species. The percentage of *E. strigatus* was only 5·5 in 1929 and decreased steadily in the subsequent years. One of each sex of *E. narcissi*, which has hitherto been reported only from California and Oregon, was found in a greenhouse in Long Island where narcissus bulbs brought from the West Coast had been forced. This species is evidently not yet established on Long Island.

HARRIS (H. M.) & TATE (H. D.). **A Leaf Miner attacking the cultivated Onion.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 515–516. Geneva, N.Y., April 1933.

Typical leaf-mining injury to onion foliage observed in 1930 and 1932 in a district in Iowa was found to be due to *Agromyza pusilla*, Mg., a widely distributed species allied to *Phytomyza atricornis*, Mg., and *Dizygomyza cepae*, Her., which have been recorded as mining the leaves of *Allium* in Europe. In 1932 the mines of *A. pusilla* were present in small numbers on 17th May. Five weeks later it was estimated that they occurred at the rate of about 600,000 to the acre over a considerable area, although it is probable that not more than 50 per cent. contained larvae at any one time. Although the onion has not hitherto been included in the long list of plants known to be attacked by *A. pusilla*, it appears to be a preferred food-plant in Iowa, as the miners were much more abundant in onion fields than in surrounding fields containing other known food-plants. In the onion leaf the mine constructed is of the typical serpentine type. Larvae are most numerous on the youngest plants and in the more succulent parts of the older ones. Individual leaves containing 12 or more mines may be found in heavily infested areas, and leaves sometimes contain mines caused by larvae of different broods.

The eggs are placed beneath the epidermis of the onion leaf, the female often feeding on the juices that issue from the recently cut edges. The egg stage lasts 3–5 days, and the larval stage 5–7. The mature larva usually drops to the ground to pupate in a crack in the soil, but pupation may take place in the mine in the leaf. The pupal stage lasts 8–12 days, the total life-cycle thus occupying about 3 weeks. There are several generations annually, so that the larval tunnels are very numerous by the end of the season, but the injury caused appears to be of minor importance. On onion *A. pusilla* is subject to severe parasitism, which increases progressively with the season, so that the majority of the insects emerging from infested leaves collected in late autumn are Hymenopterous parasites.

WILDMAN (J. D.). **Note on the Use of Microorganisms for the Production of Odors attractive to the Dried Fruit Beetle.**—*J. Econ. Ent.*, xxvi, no. 2, pp. 516–517, 2 refs. Geneva, N.Y., April 1933.

In tests carried out to determine the possibilities of the controlled use of micro-organisms in baits for the Nitidulid, *Carpophilus hemipterus*, L., which causes considerable damage to figs in California, small wide-mouthed bottles were used, each fitted with an inverted paper cone, with an opening in the cone about the size of the eye of a fig. Several types of mould and yeast grown upon waste dried

fruit were used as bait. The fruit was soaked and cooked to the consistency of gruel and then placed in petri dishes. The six organisms used were *Botrytis* sp., *Cladosporium* sp., *Rhizopus* sp., *Fusarium* sp., *Aspergillus niger* and yeast. A single inoculation of each of these was made in cooked dried figs and cooked dried peaches. At the end of 5 days the contents of the 12 plates were transferred to the small bottles, which were then set out in a fig orchard. Each bottle was sunk to the neck in the soil to minimise the effect of the hot sun on the culture, 6 traps of one medium being set round the base of one tree about 3 ft. from the trunk, and the remaining 6 under the next tree in the row. The traps were examined after 3 days. All the baits had attracted the beetles in fairly large numbers (88–433), in spite of the competition offered by ripening figs. In a later experiment, traps containing uninoculated fruit caught no beetles whereas as many as 70 were found in those containing inoculated fruit.

LINSLEY (E. G.). **A new Species of *Neoclytus* from White Fir.**—*Pan-Pacif. Ent.*, ix, no. 2, pp. 93–94, 2 refs. San Francisco, Calif., April 1933.

The Cerambycid, *Neoclytus nubilus*, sp. n., is described from *Abies concolor* at high altitudes in California.

TURNER (N.) & FRIEND (R. B.). **Control of the Mexican Bean Beetle.**—*Circ. Conn. Agric. Expt. Sta.*, no. 88, pp. 17–24, 8 figs. New Haven, Conn., January 1933.

This paper comprises a brief summary of a previous report on *Epilachna corrupta*, Muls. (Mexican bean beetle) in Connecticut [*R.A.E.*, A, xx, 300], together with some additional information obtained in 1932 [*cf.* xxi, 238]. A dust of 19 per cent. monohydrated copper sulphate, 17 per cent. calcium arsenate and 64 per cent. lime gave even better control than the magnesium arsenate dust previously recommended [*loc. cit.*] but was more expensive.

BRITTON (W. E.). **Plant Pest Handbook for Connecticut. I. Insects.**—*Bull. Conn. Agric. Expt. Sta.*, no. 344, pp. 65–182 + xi–xviii, 88 figs. New Haven, Conn., January 1933.

Brief notes are given on the bionomics and control of a large number of insect pests of cultivated plants in Connecticut, arranged under the plants attacked. Formulae for insecticides are appended.

VOGEL (M. A.) & NEISWANDER (R. B.). **The Lesser Peach Borer *Aegeria pictipes* G. & R.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, xviii, no. 2, pp. 51–54, 2 figs., 1 ref. Wooster, Ohio, 1933.

The treatment of peach trees with a solution of 1 lb. paradichlorobenzene in 2 U.S. qts. crude cottonseed oil against *Aegeria pictipes*, G. & R. [*R.A.E.*, A, xix, 630] was tried in Ohio and gave at least 73 per cent. control in 1931 and over 90 per cent. in 1932. A stronger solution (1 lb. : 1 U.S. qt.) gave a better control (at least 85 per cent.) in 1931, but was not easy to make. Effective supplementary control measures are cultural practices designed to avoid cracks and rough places in the bark, and methods of pruning that promote the formation of rounded rather than angular crotches.

de Azevedo Marques (L. A.). **Insectos damninhos á batata dôce, seus habitos e os meios de combatel-os.** [Insect Pests of the Sweet Potato, their Habits and Methods of combating them.]—*Bol. Inst. biol. Def. agric.*, no. 9, 81 pp., 18 pls. Rio de Janeiro, 1932. [Recd. May 1933.]

An account is given of the distribution and bionomics in Brazil of the weevil, *Euscepes batatae*, Waterh., the Cassidids, *Neomphalia sexpustulata*, F., *Chelymorpha cribaria*, F., *C. puncticollis*, Boh., *C. rufipennis*, Boh., *C. constellata*, Klug, and *Metriona judaica*, F. [*R.A.E.*, A, xx, 381] and three Lepidoptera, *Syntomeida syntomoides*, Boisd., *Xylomyges eridania*, Cram., and *Laphygma frugiperda*, S. & A. A dust of 1 part Paris green and 5 parts slaked lime is recommended against the Cassidids and the Lepidopterous larvae, all of which feed on the leaves of the sweet potato.

Pemberton (C. E.). **Improved Arsenical Dust for Armyworms.**—*Hawaii. Plant. Rec.*, xxxvii, no. 1, pp. 5–6, 1 ref. Honolulu, 1933.

As a result of field tests carried out in Hawaii during the summer of 1932 in connection with the control of armyworms [*Spodoptera mauritia*, Boisd.] on sugar-cane, the addition of 5 per cent. neutral mineral oil to the arsenical dusts previously noticed [*R.A.E.*, A, xxi, 15] is recommended. The adherence of the dust to the leaves was improved, and no injury was caused. The oiled dusts do not pack in storage or deteriorate. The best method of mixing the oil is to spray it into a container while the dust is slowly added.

Analyses of the residue left on leaves dusted with mixtures of white arsenic and raw rock-phosphate with and without oil, and white arsenic or calcium arsenate and raw rock-phosphate with or without one part cement, showed that over twice the amount of arsenic was present on all those receiving the oiled dust, and over three times as much in some cases. All the tests were subject to 2 ins. of rain before the samples were taken.

Pemberton (C. E.). **Introduction to Hawaii and Habits of Egg Parasite of Chinese Grasshopper.**—*Hawaii. Plant. Rec.*, xxxvii, no. 1, pp. 7–9, 3 figs. Honolulu, 1933.

A brief account is given of the steps leading to the introduction of *Scelio pembertoni*, Timb., and *S. serdangensis*, Timb., from Malaya to Hawaii against *Oxya velox*, F. (*chinensis*, Thnb.) [*R.A.E.*, A, xx, 23, 721], as the result of which a total of 44,300 individuals, principally of the former species, have been reared and distributed in sugar-cane plantations between January 1931 and January 1933. *S. serdangensis* died out in the cultures early in 1931, but *S. pembertoni* has established itself in several localities on the island of Oahu and in one locality in Hawaii itself. The adults live about 2 weeks and lay an average of about 50 eggs singly in several or all of the host eggs in the pod. Two or more eggs are sometimes laid and hatch in one of the host, but only one parasite ultimately develops. The females predominate over the males and are still capable of successful oviposition for a day or two even if they are unable to find host eggs until about 2 weeks after hatching. The life-cycle from egg to adult varies from 4 to 7 weeks with an average of about 5, which is about one-third of the time required for the complete development of the host.

DAVIDSON (J.). **The Environmental Factors affecting the Development of the Eggs of** *Sminthurus viridis* **L. (Collembola).**—*Aust. J. Exp. Biol. Med. Sci.*, xi, pt. 1, pp. 9–23, 6 diagr., 7 refs. Adelaide, 16th March 1933.

Further experiments in South Australia [*cf. R.A.E.*, A, xvi, 381 ; xx, 556, etc.] showed that the eggs of *Smynthurus viridis*, L., could develop at temperatures from 9°C. [48·2°F.] to 25°C. [77°F.] when the moisture content of the soil was approximately 15–20 per cent. (60–80 per cent. saturation), the optimum being about 75 per cent. saturation. Of eggs incubated at 25°C. [77°F.] under favourable moisture conditions, 94 per cent. hatched ; under wet conditions, corresponding to a saturated soil surface, only a small proportion hatched, most having died at various stages of development and all batches being infected with fungus hyphae. Under similar wet conditions at 20°C. [68°F.] about 50 per cent. hatched. When the moisture in the soil was below 50 per cent. saturation, the eggs developed more slowly and fewer hatched ; below 40 per cent. very few hatched. The effects of dry soil conditions varied, however, according to temperature and relative humidity of the air. Apparently more moisture was required for general hatching than for continued development in the egg. The incubation period for the species in South Australia, under favourable conditions of moisture, was found to be 19 days at 14°C. [57·2°F.], 17 at 15°C. [59°F.] and 15 at 16°C. [60·8°F.]. At similar temperatures in a dry environment development was arrested ; some of the eggs, even when partly developed, remained viable during temporary dry periods. In regions of summer rainfall, with frequent moisture changes on the soil surface accompanied by high temperatures, there would be heavy mortality amongst the developing eggs in summer. The best conditions for development and general hatching would occur when the ratio between mean daily rainfall and evaporation continued favourable and the temperature moderate, that is, near Adelaide, in April–July and again in September. These are the periods when *S. viridis* is most active and numerous, though it occurs in economic numbers throughout the winter months.

Of about 480 eggs laid by 10 unmated females none hatched.

HOLDAWAY (F. G.) & SMITH (H. F.). **Alteration of Sex Ratio in the "Flour Beetle"** *Tribolium confusum* **Duval, following Starvation of newly hatched Larvae.**—*Aust. J. Exp. Biol. Med. Sci.*, xi, pt. 1, pp. 35–43, 1 diagr., 19 refs. Adelaide, 16th March 1933.

Among larvae of *Tribolium confusum*, Duv., that had been starved for 2–3 days after hatching about 54 per cent. were females, as against less than 49 per cent. in the controls. Sex was determined at pupation. The results could not be explained by supposing a greater mortality of males, and the authors believe that they point to an actual change of sex.

VEITCH (R.). **Timber Borers.**—*Queensland Agric. J.*, xxxix, pt. 3, pp. 122–127, 2 pls. Brisbane, 1st March 1933.

A brief description is given, in the order in which they are likely to attract attention, of the commonest Coleopterous borers infesting wooden buildings in Queensland and the nature of the damage done

by each. The shot-hole borers, of which *Platypus omnivorus*, Lea (ambrosia beetle) is taken as typical, and the Buprestid, *Prospheres aurantiopictus*, Lap. & Gory (hoop pine beetle), neither of which breed in seasoned wood, are distinguished from the more serious pests, the powder post beetle, *Lyctus brunneus*, Steph. [*cf. R.A.E.*, A, xx, 270, etc.] and the Anobiid, *Calymmaderus incisus*, Lea (Queensland furniture beetle), which attacks wood in a somewhat similar manner to the European *Anobium* [*punctatum*, DeG.].

Entomological Investigations.—*6th Ann. Rep. Coun. Sci. Industr. Res. Aust. 1931–32*, pp. 20–23. Canberra, 1932. [Recd. May 1933.]

Most of the information in this report of the work of the Division of Economic Entomology in Australia has already been noticed. The life-history of *Aphodius tasmaniae*, Hope, a serious pest of lawns and pastures, has been studied. It inhabits a vertical burrow during the day and appears at the surface at night to feed. Complete control was obtained with a spray of 4 lb. lead arsenate in 100 gals. of water per acre when applied twice in one week early in March and once in late April, and also with a top dressing of powdered lead arsenate mixed with sand, but the latter is too expensive for use on ordinary pastures.

Three natural enemies of *Eriococcus* (gum scale) were transported to New Zealand, and a preliminary study was begun of the natural enemies of the Chrysomelid, *Paropsis* [*dilatata*, Er.], which is also a pest of *Eucalyptus* in that country [*cf. R.A.E.*, A, xix, 221].

Of recent years grasshoppers have caused severe damage in various parts of Australia. The life-histories of several of the common species have been worked out with a view to distinguishing the early stages of those responsible for the outbreaks.

Strickland (E. H.). **Insect Pests of Grain in Alberta.**—*Bull. Coll. Agric. Univ. Alberta*, no. 24, 58 pp., 11 figs. Edmonton, Alberta, February 1933.

Notes are given on the bionomics and control of the comparatively few insects that attack cereals in the field in Alberta, with tables for their identification and references to sources of more detailed information. The measures recommended are based on the bionomics of the species concerned and, though not effecting complete eradication, will reduce the amount of damage that would otherwise result.

Mitchener (A. V.). **Vegetable Insects and their Control.**—*Circ. Dept. Agric. Manitoba*, no. 97, 8 pp. Winnipeg, April 1933.

This circular gives a tabulated list of the principal insect pests of vegetables found in Manitoba, showing the plants attacked by each, the nature of the damage and methods of control, together with formulae for the sprays and baits recommended.

Middleton (W.). **Five new Sawflies of the Genus *Neodiprion* Rohwer.**—*Canad. Ent.*, lxv, no. 4, pp. 77–84. Orillia, April 1933.

Descriptions are given of the following new species of *Diprion* (*Neodiprion*), all of which defoliate conifers in forest areas in Canada :

D. tsugae, on western hemlock (*Tsuga heterophylla*) in Alaska and British Columbia, and *D. rugifrons*, *D. nigroscutum*, *D. ferrugineum* and *D. ontarioensis* all on Jack pine (*Pinus banksiana*) in Ontario.

Dustan (A. G.). **The Effect of some Physical Factors on Onion Maggot Infestations in Light and Heavy Soils.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 20–27, 1 ref. Quebec, 1932. [Recd. May 1933.]

Infestation by the onion maggot [*Hylemyia antiqua*, Mg.] in fields near Ottawa was found to be much heavier on onions planted in a light soil (sandy loam) than in a heavy soil (clay loam). The maximum temperature 1 inch below the surface was often 10–12°F. higher in the heavy than in the light soil and the surface temperature of the former sometimes reached 124°F. Since larvae exposed to this heat in the laboratory were all killed, it is probable that there is a greater mortality in heavy soil. They may also be affected by the moisture content, since in the surface layer (to a depth of about 2 inches), which they chiefly inhabit, this was less in the heavier soil It is probable, however, that the important factor is the difference in the number of eggs laid, which was almost 10 times as great in the lighter soil. Experimentally 14 eggs were laid in pure blow sand, as against 6 in pure blue clay and 105 in an equal mixture. In both light and heavy soils more eggs were laid when the surface was kept loose than when it was hard-baked. Since the heavier soil contained more combustible matter, tests were made in which it was found that 108 eggs were laid in pure humus, as against 43 in pure sand and 182 in an equal mixture. The lighter soil was found to be slightly acid and the heavier slightly alkaline (average pH 6·7 : 7·2), and in experimental tests 126 eggs were laid in very acid soil, 78 in neutral and 24 in very alkaline soil. In this last test specimens were also included of a slightly acid soil from marshes in western Ontario, where onion maggot infestation has been unaccountably slight, but the very large number of eggs laid in them in this experiment (246 and 285) showed that there was nothing in the soil composition repellent to ovipositing females.

Painter (R. H.). **The Overwintering Habits of the Tarnished Plant Bug** *Lygus pratensis* **Linn., in the Ottawa District.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 28–31. Quebec, 1932. [Recd. May 1933.]

In studies of *Lygus pratensis*, L., in the Ottawa district [*cf. R.A.E.*, A, xix, 38], it was found that the great majority of the adults hibernate among débris lying on the ground in woods, which are therefore the chief source of infestation of spring crops. Weekly counts of bugs emerging after subjection to 90°F. out of material from areas of 25 sq. ft. at four sites in different types of woodland showed a steady increase from 14th October to 5th November, the average numbers per acre being estimated at nearly 25,000 and nearly 170,000. After this the frost set in, and the numbers dropped, owing to mortality and the difficulty of handling material. Recovery from cages set the following spring gave an average of about 60,000 per acre, which accords with the winter mortality of 50–60 per cent. inferred from other studies. It is supposed that bugs that happened to take cover in woodland in

October would generally remain in hibernation, whereas among herbaceous plants, etc., they would probably become active daily while sunny weather lasted.

DICKISON (W.). **The Grape Mealybug** (*Pseudococcus maritimus* **Ehrhorn**). **Order : Homoptera. Family : Coccidae.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 97–104, 28 refs. Quebec, 1932. [Recd. May 1933.]

A list of the species of *Pseudococcus* found in a preliminary survey in Canada, a key to which is given, includes *P. aurilanatus*, Mask., *P. timberlakei*, Ckll., *P. citri*, Risso, *P. maritimus*, Ehrh., and *P. comstocki*, Kuw., *P. maritimus* being the commonest. In greenhouse studies in the Eastern Provinces, the author failed to find *P. citri* and *P. adonidum*, L. (*longispinus*, Targ.), the two species commonly reported, but *P. maritimus* was widely distributed. All stages of this mealybug are described. The egg stage averaged 13·2 days. The females reached maturity 43 days after hatching and lived a further 31 days, the corresponding periods for males being 30 and 4 days. An average of 231 eggs was laid after a pre-oviposition period of 10–14 days, in a waxy ovisac. The larvae began to feed a day or two after hatching. After the first moult, they showed a tendency to migration, in which ants might form an important factor, and the females then settled down in the axil of a leaf, branch or stem to feed. After this, unless disturbed, they often remained stationary. Second-instar males settled under a leaf or at the base of a plant or flower-pot and formed a silken pupal case. The females had 3 moults in all, and the males 4. The species has over 80 known food-plants ; a heavy infestation may cause yellowing of leaves or dropping of petals. The author mentions some control measures commonly employed [*cf. R.A.E.*, A, xvi, 269 ; xviii, 659] but considers that no satisfactory treatment has yet been found.

SUTHERLAND (J. R. G.). **Some Observations on the Common Mealybug,** *Pseudococcus citri* **Risso.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 105–118, 2 pls., 27 refs. Quebec, 1932. [Recd. May 1933.]

This is an account of studies of *Pseudococcus citri*, Risso, on *Coleus* in Canada, under greenhouse conditions at about 68°F. and on single leaves in vials at 70°F. and 79–84 per cent. relative humidity. All stages are described, and a new technique devised for mounting specimens. The average number of eggs in one ovisac was 172, and the incubation period was 9–15 days with an average of 11·2 [*cf. R.A.E.*, A, xx, 640]. The three instars of the female occupied an average total of 37·8 days, followed by an adult life of 25·2 days ; the four male instars totalled 29·3 days, with an adult life of 5·2. The behaviour at different stages did not markedly differ from that of *P. maritimus*, Ehrh. [see preceding paper], but the females were perhaps less sedentary. In experiments in which the movements of individual females on black paper were observed, the average distance covered in an hour by individuals in the first instar was 69·1 inches, in the second 25·2 and in the third 38, while adults averaged 25·5. Several second instar females passed below water-level in the vials ; one lived 77 days under water, but in no instance did moulting take place after immersion. Eggs laid by unmated females were not viable.

Petch (C. E.) & Maltais (J. B.). **The Carpenter Worm,** *Prionoxystus robiniae* **Peck, and its Control.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 131–136, 4 figs. Quebec, 1932. [Recd. May 1933.]

The Cossid, *Prionoxystus robiniae*, Peck, which is widely distributed as a pest of shade trees in the United States and Canada, was observed in 1928–30 attacking silver maples (*Acer saccharinum*) near Montreal. Those attacked were all old trees near houses or in open fields, or at the extreme edge of woods near other centres of infestation, suggesting that the females oviposit only on old or sickly trees growing in open country. The earliest oviposition observed was on 26th June. The eggs, of which a single female has been reported to lay 200–300, were deposited irregularly in crevices round the edges of scars or wounds. After hatching, the larvae bored through the bark and began to feed on the cambium. There they remained over a year, during which period there were no signs of tunnel-making. About July of the second year they were strong enough to start feeding in the sapwood and somewhat deeper. By June of the third year they had entered the heart-wood, where the pupal stage was reached in May of the fourth year. The pupal cases of emerged adults were found at the mouths of tunnels in June. As an experimental control measure, loose bark was first stripped from infested trees and the wound cleared of old castings; when, after a few days, inhabited tunnels could be identified by the presence of fresh castings, a mixture (thick enough to drop but not run off a paint-brush) of calcium cyanide and raw linseed oil was forced into them with a grease-gun, the paint-brush being used to brush back any that exuded. This treatment gave an average control of 92 per cent., sometimes even 100 per cent. The trees should be inspected periodically for reinfestation.

Twinn (C. R.). **Summary of Insect Conditions in Canada, in 1930.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 149–168. Quebec, 1932. [Recd. May 1933.]

This paper surveys the status of a large number of the chief insect pests in the different Provinces of Canada in 1930. The iris borer (*Macronoctua onusta*, Grote) was reported for the first time from New Brunswick, on wild iris. The false chinch bug (*Nysius ericae*, Schill.) attacked potatoes and cherries in British Columbia [*cf. R.A.E.*, A, xix, 694]. Serious damage was done to cruciferous crops in Nova Scotia and Ontario by *Aphis* (*Rhopalosiphum*) *pseudobrassicae*, Davis, and to oats in the Prairie Provinces by *Toxoptera graminum*, Rond., of which this is the first outbreak recorded there. *Hemerophila pariana*, Clerck (apple and thorn skeletoniser) [*cf.* xx, 447] has now been recorded from all the eastern Provinces except Prince Edward Island. In British Columbia widespread injury was caused to hemlock [*Tsuga*] by the Geometrid, *Ellopia somniaria*, Hulst [*cf.* xx, 31] and the Syrphid *Chilosia alaskensis*, Hunter (hemlock bark maggot), and to western yellow pine [*Pinus ponderosa*] and lodgepole pine [*P. contorta*] by the bark-beetle, *Dendroctonus monticolae*, Hopk. Injury by the poplar and willow borer (*Cryptorrhynchus lapathi*, L.) was reported from New Brunswick and British Columbia. *Pteronus* (*Pteronidea*) *cornelli*, Marl., not previously recorded from Canada, was reported as injuring poplars in Saskatchewan.

DAVIAULT (L.). **The Pine Shoot Moth,** *Rhyacionia* (*Evetria*) *frustrana* **Comstock, in the Province of Quebec.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl. 1930–32*, pp. 170–172, 4 refs. Quebec, 1932. [Recd. May 1933.]

Only one generation of *Rhyacionia frustrana*, Comst. [*cf. R.A.E.*, A, xviii, 319] was observed on *Pinus resinosa*, *P. sylvestris* and other conifers in Quebec in 1931. Hibernation occurred in the pupal stage in small, silky cocoons on the trunk or in refuse on the ground [but *cf.* xviii, 392]. Eggs were laid singly or in groups of 2–3 on the needles or buds, and the incubation period averaged 10–15 days. The newly hatched larva, though it could easily live for a day without food, usually settled immediately on a bud or at the base of a needle on a new shoot, where after weaving a protective web, which it coated with resin, it began to feed, finally tunnelling into the shoot, inside which the larval period was completed. The tunnel was always left open. Parasitism by three species of Hymenoptera amounted to about 20 per cent.

Diseases, Insects, and other Pests injurious to Plants.—*6th Bienn. Rep. Dir. Kansas Agric. Expt. Sta. 1930–32*, pp. 85–100. Manhattan, Kans., December 1932. [Recd. May 1933.]

Some of the work referred to in this report for the two years ending 30th June 1932 has already been noticed [*R.A.E.*, A, xix, 434 ; xx, 43, 176, 409]. A list is given of the grasses that are favourite food-plants of the wheat stem maggot [*Meromyza americana*, Fitch], which apparently has 3 generations a year in Kansas. The wheat straw-worm [*Harmolita grandis*, Riley] was found to oviposit nearly always in the developing bud ; if this could not be reached, egg-laying was suppressed. Plants of which the crown was well buried in the soil were seldom infested. Adults of the apple curculio [*Tachypterellus quadrigibbus*, Say] were found to hibernate in decaying organic matter ; only a few were found in blue-grass [*Poa*] sod. Infestation has been somewhat lowered by destroying, for several successive years, the apples that dropped in June [*cf.* xvi, 505 ; xvii, 70]. In a survey of insects found in *Sorghum* fields, *Aphis maidis*, Fitch, was found to be more adapted to *Sorghum* than to maize [*cf.* xx, 674]. From further studies of wireworms reared in captivity [*cf.* xvii, 227], data were secured on the life-history of *Drasterius elegans*, F., *Conoderus* (*Monocrepidius*) *vespertinus*, F., *C.* (*M.*) *lividus*, DeG., and *Melanotus* sp. The complete life-cycle of *Melanotus*, which is a common pest of maize, occupied 3 years, a shorter period than generally supposed [*cf.* xvii, 70]. The amount of wireworm infestation was shown to be determined by other factors besides crop rotation [*cf.* xviii, 476] ; in a field planted with *Sorghum* in 1930, and with maize in 1931, wireworms were found, though less abundantly, in approximately the same areas as in 1924, although the field had been under lucerne throughout 1925–29. The thrips chiefly attacking lucerne flowers was *Frankliniella tritici*, Fitch ; the leaves were attacked by *F. fusca*, Hinds, and *Aeolothrips bicolor*, Hinds. Unusual damage was done in 1931 to vine leaves, young apples and the bark of *Prunus mahaleb* by larvae of the variegated cutworm [*Lycophotia margaritosa*, Haw.], an outbreak of which started in a field of vetch. It was controlled by scattering poisoned bran mash and ploughing up the vetch. About 30 per cent. of the larvae were parasitised by *Apanteles militaris*, Walsh. A local outbreak of the garden web-worm [*Loxostege similalis*, Gn.] on lucerne was unusual in that more

damage was done by the first brood of larvae than by the second. Some damage was done to lucerne locally by larvae and adults of the clover-leaf weevil (*Hypera punctata*, F.), which appears to be on the increase. A lead arsenate spray [*cf.* xiv, 470] did not give adequate control. Pounded maize cobs made an excellent substitute for bran in baits for grasshoppers and cutworms. It was found that the leaf-hoppers occurring on native prairie grasses in Kansas did not breed on cultivated grasses, and those breeding on the latter, even including such widely distributed species as *Deltocephalus inimicus*, Say, *D. striatus*, L., *Cicadula divisa*, Uhl., and *Euscelis obscurinervis*, Stål., had not adapted themselves, except for limited adult feeding, to the prairie grasses, which, unless artificially cultivated, had a relatively small insect fauna of any kind.

Studies of the dispersal of adult codling moths [*Cydia pomonella*, L.] in an apple orchard showed that movement from tree to tree is restricted [*cf.* xxi, 223] ; most of the breeding population on each tree is derived from larvae that have overwintered on the same tree. Oviposition is inhibited by an air movement of 4 miles per hour. It is heavy in spring when the early evening temperature is as high as 65°F. ; after 25th May conditions for it in Kansas are generally favourable for the rest of the season. In the hottest weather it usually takes place only after the temperature has passed its daily minimum, *i.e.*, about 6–7 a.m.

SATTERTHWAIT (A. F.). **Larval Instars and Feeding of the Black Cutworm,** *Agrotis ypsilon* **Rott.**—*J. Agric. Res.*, xlvi, no. 6, pp. 517–530, 3 diagr., 8 refs. Washington, D.C., 15th March 1933.

The paper deals with investigations in a field laboratory in Montana on larvae of *Agrotis ypsilon*, Hfn., from material collected in a flooded area in Arkansas in 1928–29. Three annual generations were observed, the adults emerging from overwintered pupae in April–May. While the larvae generally complete their development in 6 instars, which were described by Crumb in a paper already noticed [*R.A.E.*, A, xviii, 35], some were observed to pass through a 7th and a few females through an 8th, which are here described. Since all were fed exclusively on maize leaves, the greater number of instars can scarcely be attributed, as with *Luperina stipata*, Morr. [xviii, 584], to less nourishing food. A cool period during the growth of the first instar prolonged this from 2 to 11 days, and the whole larval periods were correspondingly 27 and 43 days and the complete life-cycles 49 and 56 days. The slower development was probably accompanied by a greater mortality. A single May-brood larva, developing in 6 instars, was found to eat an average of 65 sq. ins. of maize leaves, and a 7-instar larva over 75 sq. ins., the bulk of the feeding in either case being done in the last instar and females eating more than males. The July brood ate less. In the field the larvae may waste a thousand times as much as they eat.

MUESEBECK (C. F. W.). **Five new Hymenopterous Parasites of the Oriental Fruit Moth.**—*Proc. Ent. Soc. Wash.*, xxxv, no. 4, pp. 48–54. Washington, D.C., April 1933.

The following parasites are described from *Cydia* (*Grapholitha*) *molesta*, Busck : the Braconids, *Microdus* (*Bassus*) *diversus*, sp. n., and *Orgilus longiceps*, sp. n., from Japan, and *Phanerotoma grapholithae*, sp. n., and *Apanteles molestae*, sp. n., from Japan and Korea, and the Bethylid, *Perisierola angulata*, sp. n., from Australia [*cf. R.A.E.*, A, xx, 423].

Gilmer (P. M.) & Parker (R. L.). **The Codling Moth in southern Kansas and Recommendations for its Control.**—*Bull. Kansas Agric. Expt. Sta.*, no. 263, 29 pp., 6 figs., 1 ref. Manhattan, Kans., 1933.

This bulletin summarises the results of six years' work on the life-history and control of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple in southern Kansas, where it is very numerous and has 2½–3½ broods a year. A spray containing 2 lb. lead arsenate to 50 U.S. gals. water gave much better results than one with 1½ lb.; a 2½ lb. spray gave rather better results, but is not recommended. For most trees 20–30 U.S. gals. per tree should be used at each spraying. Spray schedules and technique are discussed in some detail. It is recommended that the packing-shed should be darkened and a screened wire-gauze trap put in the roof to catch emerging moths.

Stickney (F. S.) & Yust (H. R.). **Elimination of Natural Mortality as a Factor in Determining the Effectiveness of Hydrocyanic Acid Gas on the California Red Scale.**—*J. Agric. Res.*, xlvi, no. 5, pp. 437–447, 2 graphs. Washington, D.C., 1st March 1933.

In calculations to ascertain the success obtained in fumigating *Citrus* with hydrocyanic acid gas for the control of *Chrysomphalus aurantii*, Mask., natural mortality as ordinarily computed, *i.e.*, by reckoning the proportion on control trees of living scales to the total number of living and dead scales, has ranged from 1 to 71 per cent. In a series of counts of female scales, from the fully developed second stage to the mature adult stage, on lemon fruits from untreated trees, in which dead scales were entirely disregarded, it was found that among the remainder the proportion of dying scales was relatively constant, ranging from 0 to 9 per cent. with a steady average of about 4 per cent. It remained constant on fruits from different trees and different parts of the tree, and was not appreciably affected by size of fruit, severity of infestation, protection of foliage, time of year (January or May) or time and conditions of storage (0–50 days at 55·4–78·8°F.). The average was slightly higher on ripe than on unripe fruit. In 7 counts on fruit from one grove the range in percentage of mortality, thus reckoned, was only 2·3, whereas the percentage of living scales to the total number of scales varied by 13·5. Among developed females, dying scales can be distinguished from living ones by discoloration; dead scales, as distinct from dying ones, are visibly dried up. It is suggested that counts on fruit from fumigated trees should be made in the same way, by disregarding dried scales that had died before treatment. On fruit stored promptly after treatment, dying scales could be distinguished from living ones after 4 days, and from dead ones for a week longer at 78·8°F. or two weeks at 55·4°F. The natural mortality may then be eliminated by counts on control trees on the same principle. Under conditions similar to those of this experiment (at Whittier, California), 4 per cent. might be assumed as a constant.

Edwards (W. H.). **The Damage caused by Ants in Seed Beds and Garden, and how to Control the Pest.**—*J. Jamaica Agric. Soc.*, xxxvii, no. 4, pp. 187–189, 1 diagr. Kingston, Jamaica, April 1933.

In Jamaica, freshly sown or newly germinated seeds are frequently carried from the nurseries by ants, one of the most destructive being

Solenopsis geminata, F. (fire ant). Their habits are briefly outlined. The nests, which can be located by following the trails of workers carrying food, may be destroyed in uncultivated situations by the liberal application of boiling water or 1 oz. potassium cyanide dissolved in 1 gal. water. On cultivated land, excellent results have been obtained with an emulsion of 3 oz. hard soap dissolved in 1 pint boiling water with the addition of 2 pints kerosene and finally of 1½ pints creoline, crude carbolic acid or Jeyes fluid. For use in seed beds immediately before planting or on germinating seedlings, the stock emulsion should be diluted at the rate of 1 : 100 ; on more resistant plants and on lawns it should be used at the rate of 2 : 100. The soil round the edge of the nest should first be soaked with the liquid, which should then be poured over the centre.

When no delicate plants are in the immediate vicinity of the nest, about one tablespoonful of carbon bisulphide or about half a teaspoonful of calcium cyanide dust may be poured into each of several holes 8–12 ins. deep and about the same distance apart, the openings to which may be closed with moist earth, soil or dirt. Calcium cyanide is less toxic to plants than carbon bisulphide.

Seeds sown in boxes can be protected from attack by placing them on a framework supported on legs, which should stand in tins containing water and kerosene, or should be banded with cotton fabric applied about 6 ins. from the ground and treated with a solution of mercury bichloride or an adhesive. Inverted cones may be fixed above the bands. A mixture that will remain adhesive for relatively long periods may be prepared by dissolving about 2 lb. resin in 3½ pints boiling castor oil and raw linseed oil in equal parts ; it should be painted on the posts in bands 3–4 ins. wide. A poisonous though less durable banding material is made by melting 1 lb. resin in 1¾ pints hot castor oil and gradually adding 4 oz. finely powdered mercury bichloride while the mixture is cooling.

PEARSON (E. O.). **Notes on the Genus** *Dysdercus* **(Hemiptera-Heteroptera) in Trinidad, B.W.I.**—*Psyche*, xxxix, no. 4, pp. 113–126, 12 figs., 14 refs. Cambridge, Mass., December 1932. [Recd. May 1933.]

Descriptions are given of the four species of *Dysdercus* (cotton stainers) found in Trinidad, with notes on their distribution and synonymy [*cf. R.A.E.*, A, xviii, 108 ; xix, 721]. *D. howardi*, Ballou, and *D. maurus*, Dist., (*howardi* var. *minor*, Ballou) feed and breed in Trinidad on *Eriodendron anfractuosum*, *Hibiscus cannabinus*, *H. sabdariffa*, *Malachra capitata* and *Thespesia populnea*, as well as on all varieties of cotton. *D. mimus*, Say (*albidiventris*, Stål), occurs on the same plants and also on *Sida* spp. The food-plants of *D. fernaldi*, Ballou, in Trinidad are not known to the author.

HOOD (J. D.). *Rhabdothrips albus*, **a new Genus and Species of Thysanoptera from Panama.**—*Proc. Ent. Soc. Wash.*, xxxv, no. 4, pp. 45–48, 5 figs. Washington, D.C., April 1933.

A description is given of the macropterous female of *Rhabdothrips albus*, gen. et sp. n., which is not uncommon though never abundant on the leaves of young banana plants in Panama and which may be predacious, as no injury attributable to it has been observed.

BLANCHARD (E. E.). **Aphid miscellanea.**—*Physis*, xi, no. 38, pp. 19–36, 9 figs. Buenos Aires, December 1932. [Recd. May 1933.]

New species described include the following on cultivated plants in Argentina : *Macrosiphum bosqi* on *Pelargonium graveolens*, *M. cocoensis* on *Tanacetum vulgare*, and *M. griersoni* on artichoke (*Cynara scolymus*).

KUWAYAMA (S.). **Insect Pests of Strawberry in Japan.** [*In Japanese.*] —*Yengei*, xxiv, nos. 10–11, reprints 7 & 9 pp. Sapporo, 1932.

Notes are given on 34 insects known to attack strawberry in Japan. Of these the Tenthredinid, *Emphytus albicinctus*, Mats., which is widely distributed in Hokkaido and feeds on a variety of plants, is one of the most important, the injury being particularly serious in July. There are two broods a year, the winter being passed in the prepupal stage. The adults emerge in late May and again in early September, ovipositing in the tissues of the lower surface of the leaves. The Curculionid, *Pseudocneorrhinus bifasciatus*, Roelofs, and the Galerucid, *Galerucella distincta*, Baly, also feed on the leaves of strawberry, the latter having two generations a year and passing the winter in the adult stage.

ESAKI (T.) & HASHIMOTO (S.). **Report on the Leaf-hoppers injurious to the Rice Plant and their natural Enemies. No. 4 (for the year 1932).** [*In Japanese.*]—32 pp., 4 pls. Fukuoka, March 1933.

In 1932 leafhoppers were comparatively scarce in the fields near Fukuoka, though *Nilaparvata oryzae*, Mats., was more numerous than usual. It had 5 generations during the season, and the brachypterous forms were common in the field, but did not appear in the laboratory. Second and third generation females lived for average periods of 27·1 and 35·9 days respectively, the corresponding figures for males being 24·1 and 30·8. Single females of the second and third generations laid 141 and 217 eggs, and the nymphal stage lasted 12–24 days [*cf. R.A.E.*, A, xx, 380]. Descriptions are given of the nymphal instars and of the adults of *N. oryzae* and *Delphacodes striatella*, Fall.

Dryinid parasites obtained were *Echthrodelphax bicolor*, Esaki & Hashimoto, from *Sogata furcifera*, Horv., *Pseudogonatopus flavifemur*, Esaki & Hashimoto, from *N. oryzae* and *Epigonatopus sakaii*, sp. n., from *Nephotettix bipunctatus*, F. Descriptions are given of *E. sakaii* and also of the Mymarids, *Anagrus* sp. and *Alaptus* sp., which parasitise the eggs of the Jassids, *Cicadella viridis*, L., and *Erythroneura mori*, Mats., respectively.

Experiments were made on the possible transmission of a virus disease of rice by *N. bipunctatus*, but the results were inconclusive.

OKAMURA (T.). **On the Vitamin B in Rice harvested from Plants injured by *Chilo simplex*, Butl.** [*In Japanese.*]—*Nogaku Kenkyû*, xx, pp. 111–124. Kurashiki, Japan, 1933.

Feeding experiments with fowls showed that rice harvested from plants injured by *Chilo simplex*, Butl., contained a little less vitamin B than rice from normal plants.

KAMIYA (K.). **Studies on the Food-habits of May-beetles. I.** [*In Japanese.*]—*Kontyû*, vii, no. 1, pp. 6–12. Tokyo, May 1933.

Vines and chestnuts are attacked by the adults of various Lamellicorns near Tokyo, of which the Rutelid, *Anomala rufocuprea*, Motsch., is far the most abundant. It is most numerous in August.

ISHII (T.). **Notes on two Hymenopterous Parasites of Thrips in Japan.** [*In English.*]—*Kontyû*, vii, no. 1, pp. 13–16, 1 pl., 1 fig. Tokyo, May 1933.

Descriptions are given of the Eulophids, *Thripoctenus brui*, Vuillet, bred from *Thrips tabaci*, Lind., and *Taeniothrips* sp. on onion near Tokyo, and *Thripoctenus bicoloratus*, sp. n., from a thrips on pepper (*Piper*). *T. brui* also occurs in the Philippines.

ISHII (T.). **On the Biology of** *Chelonus munakatae* **Munakata.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, v, no. 1, pp. 13–16, 1 fig. Tokyo, February 1933.

Descriptions are given of the eggs and each of the four larval instars of *Chelonus munakatae*, Munakata, which occurs in Japan, Korea and China. This Braconid oviposits in the eggs of *Chilo simplex*, Butl., but the larvae do not hatch until 9 days after those of the latter, the period from oviposition to larval maturity occupying 41 days [*cf. R.A.E.*, A, xix, 262].

NAGASHIMA (K.). **On the Biology of** *Apanteles glomeratus* **L.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, v, no. 1, pp. 17–25, 5 figs. Tokyo, February 1933.

The Braconid, *Apanteles glomeratus*, L., which has 8 generations a year in Japan, hibernating in the pupal stage, sometimes parasitises over 95 per cent. of the larvae of *Pieris rapae*, L. In one case 90 parasites emerged from a single host, but the usual number is 5–30.

YAGO (M.). **On** *Phyllobius incomptus*, **Sharp.** [*In Japanese.*]—*J. Plant Prot.*, xx, no. 3, pp. 200–211, 2 pls. Tokyo, March 1933.

The adults of *Phyllobius incomptus*, Sharp, attack the flower buds, flowers and young leaves of pear in spring near Shizuoka, and also feed on peach, plum, chestnut and oak. There is one generation annually, the winter being passed in the larval stage in the soil. Pupation takes place in February and March, and the adult weevils which crawl actively but are hardly able to fly, emerge in April. They live for about 40 days, females laying some 100 eggs in about a fortnight. The eggs, which hatch in 2–3 weeks, are laid on the leaves, but the larvae occur in the soil, without, however, causing any apparent injury to the pear roots. Spiders and frogs feed on the weevils. Spraying with lead arsenate in April is recommended for control.

YOSHINA (G.). **On** *Euscepes* (*Cryptorrhynchus*) *batatae* **Waterh.** [*In Japanese.*]—*J. Plant Prot.*, xx, no. 3, pp. 219–225. Tokyo, March 1933.

Euscepes (*Cryptorrhynchus*) *batatae*, Waterh., the adult of which is described, is very injurious to sweet potato in the Caroline Islands,

causing more damage than *Cylas formicarius*, F. *Ipomoea pes-caprae* is also attacked. The eggs are laid singly in the parts of the stalks and roots injured by the adults and hatch in about a week. One female produces 40–95 eggs, and the weevils live for 13 weeks. The larvae, which bore into the food-plant, mature in about 25 days, and the pupal stage lasts about a week. Early maturing varieties of sweet potato and those with pale leaves and buds, thin stalks and roots deep in the soil are less injured.

Compendium of the Control of Insects and Fungi injurious to Agricultural Plants in Formosa. (1) Insect Pests of Fruit Trees. [*In Japanese.*]—*Publ. Govt. Formosa, Bur. Industry*, no. 636, 183 pp., 22 figs., 12 col. pls. Taihoku, March 1933.

In this work, which has been prepared by several entomologists in co-operation, 149 species of insects attacking fruit trees in Formosa are briefly described, and notes are given on their bionomics and control.

TAKANO (S.). **On the Methods of artificial Multiplication and Liberation of *Trichogramma* spp.** [*In Japanese.*]—*Dobuts. Zasshi*, xlv, pp. 132–134. Tokyo, March 1933.

Trichogramma australicum, Gir., and *T. japonicum*, Ashm., are used for the control of the Pyralid borers infesting sugar-cane in Formosa. They are reared on eggs of *Sitotroga cerealella*, Ol., and to a less extent of *Ephestia cautella*, Wlk., with very successful results. The technique adopted is described in detail.

TAKAHASHI (R.). **Notes on the Dimorph of *Periphyllus formosanus* Takahashi (Aphididae).**—*Trans. Nat. Hist. Soc. Formosa*, xxiii, no. 124, reprint 3 pp. Taihoku, February 1933.

A description is given of the dimorph, or larval form adapted to aestivation, of *Periphyllus formosanus*, Takah., which feeds on maple (*Acer*) in Formosa, with a key to the dimorphs of other species of the genus.

FERRIÈRE (C.). **Chalcidoid and Proctotrupoid Parasites of Pests of the Coconut Palm.**—*Stylops*, ii, pts. 4–5, pp. 86–96, 97–108, 12 figs. London, April–May 1933.

Systematic notes, with descriptions of new species, are given on the following parasites: The Chalcids, *Antrocephalus renalis*, Wtst., from pupae of *Tirathaba* spp. in Fiji, occurring also in India [*R.A.E.*, A, x, 573] and the Philippines, *Irichohaltichella tirathabae*, sp. n., from pupa of *T. rufivena*, Wlk., and cocoon of *Apanteles tirathabae*, Wlkn., in Java, and *Anacryptus impulsator*, Wlk. (which was originally described from Celebes) from pupa of *Tirathaba* sp. in Java; *Eurytoma* sp. from pupa of *T. mundella*, Wlk., containing dead adults of *Trichospilus pupivora*, Ferrière, in Java; *Perilampus microgastris*, Ferrière, from a species of *Apanteles* parasitising *Tirathaba* sp. in Java [*cf.* also xix, 28]; the Eupelmid, *Anastatus axiagasti*, sp. n. (with var. *rufithorax*, n.) from eggs of *Axiagastus cambelli*, Dist., in the Solomon Islands; *Elasmus* (*Cyclopleura*) *fumipennis*, Cam. (which was originally described from Borneo) from prepupae of *Tirathaba* spp. in Java, and *E. hispidarum*, sp. n., from *Promecotheca reichei*,

Baly, in Fiji ; the Eulophids, *Trichospilus pupivora*, Ferrière, from pupae of *Tirathaba* spp. in Java, Malaya and New Guinea [*cf.* also xix, 28], *Dimmockia javanica*, sp. n., an external parasite of larvae of *Promecotheca* sp. in Java, *Pleurotropis detrimentosus*, Gahan, from larva of *Plesispa reichei*, Chap., and, as a hyperparasite of *Promecotheca* sp., from *D. javanica* in Java [*cf.* also xviii, 285], *Pleurotropis painei*, sp. n., an internal parasite of pupa of *Promecotheca* sp. in Java, *Pleurotropis parvulus*, sp. n., an internal parasite of larva and pupa of *Promecotheca* sp. in Java, *Achrysocharis promecothecae*, Ferrière [xix, 538], *Achrysocharella orientalis*, sp. n., probably a hyperparasite of *Promecotheca* sp. in Java, *Closterocerus splendens*, Kow., from *Promecotheca* sp. in New Guinea, originally described from *P. opacicollis*, Gestro, in the New Hebrides, *Tetrastichus taylori*, sp. n., from *Promecotheca bicolor*, Maulik, and, as a hyperparasite of *Promecotheca reichei*, from *Elasmus* in Fiji, *Tetrastichodes plesispae*, sp. n., from larvae of *Plesispa reichei* in Java, *T. brontispae*, sp. n., from larva and pupa of *Brontispa longissima*, Gestro (Java) and *B. froggatti*, Sharp (New Guinea), *Syntomosphyrum javanicum*, sp. n., a hyperparasite of *Tirathaba* sp., from *Anacryptus impulsator* and *Erycia basifulva*, Bezzi, in Java, *S. zygaenarum*, sp. n., from Tachinid parasites of Zygaenids in the Solomon Islands, perhaps occurring also in Java, and *Melittobia hawaiiensis*, Perk., from Tachinid larvae in the Solomon Islands and Malaya and from the Chalcid, *Brachymeria salamonis*, Cam., in the Solomon Islands ; the Trichogrammatids, *Trichogrammatoidea nana*, Zehnt. (which is distinguished from species of *Trichogramma*) from the eggs of various Lepidoptera in Fiji, Java and Sumatra, and of *Brontispa froggatti* in the Solomon Islands, and *Oligosita utilis*, Kow. (*Chaetostricha cratitia*, Wtst. [x, 527]) from eggs of *Promecotheca reichei* and *P. bicolor* in Fiji, originally described from *P. opacicollis* in the New Hebrides ; the Diapriid, *Trichopria tachinidarum*, sp. n., from Tachinid parasites of *Tirathaba* sp. in Java ; *Calliceras manilae*, Ashm., from cocoons of *Apanteles tirathabae* in Java, also occurring in the Philippines and probably in India, and *C. fijiensis*, sp. n., from *A. tirathabae* in Fiji ; and the Scelionids, *Telenomus tirathabae*, sp. n., from eggs of *Tirathaba* sp. in Java, perhaps also occurring in Fiji, and *Microphanurus painei*, sp. n., from eggs of *Axiagastus cambelli* in the Solomon Islands.

A key is given to the species of *Pleurotropis* occurring in Southern Asia.

LEVER (R. A.). **Entomologist's Annual Report for the Year 1931–32.** —*Brit. Solomon Is. Prot. Agric. Gaz.*, i, no. 1, pp. 3–6. Tulagi, January 1933.

Most of the information on coconut pests in the Solomon Islands in this report has already been noticed [*R.A.E.*, A, xxi, 207]. An undetermined Coreid of the genus *Dasynus* has caused considerable injury to the young nuts before the stigma protrudes and the male flowers fall. The eggs, which are widely distributed, hatch in 8–9 days. The nymphs inhabit the crowns of the palms, and the adults have also been found feeding on galls on the leaves of the euphorbiaceous plant, *Macaranga tanarius*. Two mealybugs observed on coconut are *Phenacoccus horridus*, Green (MS.), which is fostered by the ant, *Oecophylla smaragdina*, F., and spread by it on the young nuts, and *Pseudococcus leveri*, Green (MS.), which occurs on the pinnae.

The Coreid, *Leptoglossus membranaceus*, F., damaged tomato plants in Guadalcanal. A kerosene emulsion spray appeared to give effective control.

HART (P. C.). **Proeven omtrent topboorderbestrijding in aanplant 1931–32.** [Experiments on combating the Tip Borer in Sugar-cane in 1931–32.]—*Arch. Suikerind. Ned. Indië*, 1933, pp. 233–271; also as *Meded. Proefst. Java-Suikerind.*, 1933, no. 8. Surabaya, 1933.

For the third year in succession experiments have been made in Java in cutting out infested shoots [*R.A.E.*, A, xix, 337; xx, 433] as a measure against *Scirpophaga intacta*, Sn., on sugar-cane. The results are discussed in detail, and it is concluded that injury by the borer can be reduced by 80 per cent. by this means.

JOCHEMS (S. C. J.). **Verslag van het Deli Proefstation over het jaar 1932.** [Report of the Deli Experiment Station for 1932.]—*Meded. Deli Proefst.*, (2) no. 84, 74 pp. Medan, 1933.

In the report of the entomologist, J. C. van der Meer Mohr (pp. 30–38), it is stated that in dusting experiments against caterpillars on tobacco 20 per cent. barium fluosilicate was found to be as effective as 6 per cent. lead arsenate. The relative abundance of the Lepidopterous pests of tobacco in Deli, Sumatra, is being investigated, and the Pyralid, *Psara* (*Pachyzancla*) *ambitalis*, Rebel, has proved to be of some importance, representing 13·6 per cent. of the larvae on one plantation.

HUTSON (J. C.). **Report on the Work of the Entomological Division** [Ceylon Dept. Agric., 1932.]—23 pp. typescript. Peradeniya, 1933.

Coconut pests recorded from Ceylon in 1932 included *Aspidiotus destructor*, Sign., prevalent in a few small areas and partly controlled by the Coccinellid, *Chilocorus nigritus*, F., *Termes* (*Cyclotermes*) *redemanni*, Wasm., which had been supposed to be only a scavenger but apparently caused direct injury to seedlings in one estate, and the weevil, *Diocalandra frumenti*, F., which was found breeding in dead bark. New pests on food crops included *Termes ceylonicus*, Wasm., attacking apparently healthy maize plants, the ants, *Solenopsis geminata*, F., on maize and *Solanum melongena*, and *Dorylus orientalis*, Westw., on carrots, onions and *Arachis nymbyquarae*, and the Pyrrhocorid, *Dysdercus cingulatus*, F., on *Hibiscus esculentus*.

Citrus was attacked by the Tineid leaf-miner, *Phyllocnistis citrella*, Stn., the fruit-fly, *Dacus ferrugineus*, F., the Lycaenid, *Chilades laius*, Cram., the Lymantriid, *Dasychira mendosa*, Hb., and the weevil, *Dereodus sparsus*, Boh., and the young shoots by the Pentatomid, *Cappaea taprobanensis*, Dall., the Coreid, *Homoeocerus* sp., *Ricania speculum*, Wlk., and *Jassus pauperculus*, Spangb. Seedlings of *Anacardium occidentale* were seriously injured by the Capsid, *Disphinctus humeralis*, Wlk., and a stem-boring caterpillar. *Anona cherimolia* was attacked by *Saissetia nigra*, Nietn., *A. muricata* by *Zeuzera coffeae*, Nietn., and *A. reticulata* by *Laccifer* (*Tachardia*) sp. Apple leaves were eaten by the Lymantriid, *Notolophus posticus*, Wlk.

Insects attacking green manure plants included *Coptotermes ceylonicus*, Holmgr., on *Albizzia stipulata*, *Calotermes* (*Neotermes*) *militaris*, Desn., on *Crotalaria anagyroides*, the Capsid, *Ragmus importunitas*, Dist., on *Crotalaria* sp., and the Membracid, *Otinotus oneratus*, Wlk., on *C. usaramoensis*. Shade and timber trees attacked by termites included some new records. Young trees of *Cassia fistula* were injured by the Cossids, *Xyleutes persona*, Le Guillou (*Duomitus leuconotus*, Wlk.) and *Z. coffeae*. Pests of oil-yielding plants included *Aleurocanthus woglumi*, Ashby, and *Phenacaspis* (*Chionaspis*) *dilatata*, Green, on *Hydnocarpus wightiana*, the Pyrrhocorid, *Melamphaus fulvomarginatus*, Dohrn, on *H. anthelmintica*, *Coptotermes ceylonicus* and the Limacodid, *Parasa lepida*, Cram., on *Aleurites fordi*, and the Sphingid, *Acherontia styx*, Westw., on *Sesamum indicum*.

Among miscellaneous pests were *Prodenia litura*, F., and *Sylepta derogata*, F., on cotton, *Myzus persicae*, Sulz., and *Phytometra* (*Plusia*) sp. on tobacco, the Pentatomid, *Menida histrio*, F., on *Sorghum*, and *Empoasca flavescens*, F., on castor (*Ricinus communis*). The Aphid, *Oregma bambusae*, Buckt., on bamboo was controlled by the Coccinellid, *Synonycha grandis*, Thnb. *Artemisia* was attacked by *Termes redemanni*, *Phytometra* (*Plusia*) *obtusisigna*, Wlk., and the Capsid, *Halticus minutus*, Reut.

Winged adults of *Calotermes* (*Glyptotermes*) *dilatatus*, Bugnion & Popoff, were reared in the laboratory from eggs laid 4½ years earlier by neoteinic adults [*cf. R.A.E.*, A, xx, 724]. Records over 5 years are now available of the treatment of more than a million tea plants with Paris green against *Calotermes militaris* [xviii, 105]. When correctly applied, at the rate of 3½ lb. per 1,000 bushes, it has proved entirely satisfactory and it is never known to have injured the bushes. One man can treat 60 a day. Where one bush contains two or more separate colonies, more than one injection is required, but such bushes are not often worth preserving. Barium fluosilicate has not proved a successful substitute. Notes are given on the destruction of termite nests with petrol [xix, 336].

Investigations at Peradeniya showed that the normal life-cycle of *Oryctes rhinoceros*, L. (coconut black beetle) [*cf.* xix, 741] is: egg stage, 12–18 days; larval stage, 3–4 months (of which the last 1–3 weeks are inactive); pupal period (including the time spent by the adult in the pupal cell), 6–9 weeks. As the life-cycle may be shorter in some districts, possible breeding-places should be cleared every two months. To compensate for loss of humus due to the necessary burning of vegetable matter, green manure crops should be grown in alternate rows between the coconut palms and turned into the soil at least once every two years.

A list is given of local timbers, suitable for packing-cases, specifying those that can be protected by seasoning against the Bostrychid, *Xylothrips flavipes*, Ill. Of various substances tested for preserving book-covers from cockroaches (*Periplaneta australasiae*, F., *P. americana*, L., and *Stylopyga rhombifolia*, Houttyn), the most effective were mercury bichloride (1 oz. in 1 pint rectified spirits) and an ammonium arsenite formula consisting of 3 gm. white arsenic in 2½ oz. dilute ammonia (1 part to 2 of water), and 50 per cent. rectified spirits. The latter was made more effective by adding beechwood creosote (¼ oz. per pint). Attempts to control the tobacco stem borer, *Phthorimaea heliopa*, Lw. [*cf.* xviii, 159; xxi, 63] with miscible oil or lead arsenate sprays have not so far succeeded.

A study was made of the bionomics of the Noctuid, *Amyna punctum*, F., which again defoliated trees of *Croton tiglium* over wide areas, its attacks being sometimes followed by infestations of *Saissetia nigra*. The females laid their eggs singly on either side of the leaves or on the twigs, beginning 3–4 days after emergence, the maximum being 898. The egg stage lasted about 3 days, and the larval and pupal stages 11–14 each. Infested trees may be banded with an adhesive and then jarred, which makes the caterpillars drop to the ground where they can be killed, or the soil may be lightly forked to expose the pupae. *Croton lacciferus* is a common wild food-plant.

HUTSON (J. C.). **The Coconut Scale** (*Aspidiotus destructor*).—*Trop. Agriculturist*, lxxx, no. 4, pp. 254–256, 1 pl. Peradeniya, April 1933.

A brief account is given of the bionomics of *Aspidiotus destructor*, Sign. (coconut scale), which is one of the most widely distributed Coccids in Ceylon, probably occurring wherever coconuts or other palms are grown ; it has also been recorded in small numbers on tea, rubber, and a variety of other plants. By sucking the sap and killing the surrounding tissue of the lower surface of the older leaves, it causes a yellow mottling of the upper surface. Up to 50 eggs are laid, and the larvae spread by wandering or being blown by wind. In the warm climate of the main coconut growing areas, breeding probably continues throughout the year, though development may be retarded during long wet periods. The females usually predominate over the males.

Owing to the activities of its natural enemies, particularly the Coccinellid, *Chilocorus nigritus*, F., *A. destructor* rarely causes damage of any great importance in Ceylon, but if control is necessary, the leaves on the older palms may be removed and burnt and the infested leaflets on the young palms, on which infestation seldom extends beyond a few small patches on the older leaves, may be removed or sprayed with kerosene emulsion two or three times at weekly intervals. The importance of vigorous growth under suitable soil conditions in the protection of palms from attack is pointed out.

Investigations on the Spike-disease of Sandal. VII.—21 pp. Bangalore, Indian Inst. Sci., 1933.

The continuation of experiments at the Indian Institute of Science on the possible transmission of spike disease of sandal [*Santalum album*] by insects [*cf. R.A.E.*, A, xx, 539 ; xxi, 131, etc.] during the six months ending 31st March 1933 is reported by M. Appanna and C. Dover (pp. 17–19). The majority of the numerous tests with the species common on sandal have been concluded, and though no definite results have been reached, it is considered that, by elaboration of the mass infection experiments, an estimate of the part played by insects will shortly be possible. In the majority of cases when previously infected individuals of the Jassids, *Moonia variabilis*, Dist., *Petalocephala* [*uniformis*, Dist.] and *Acropona walkeri*, Kirk, were fed on healthy plants a condition distinctly resembling the disease was produced, which was not present on control plants. In experiments designed to accelerate the number of tests in progress, sucking insects were found to feed readily on collodion tubes filled with sap extracted from diseased leaves. The sap is kept in cold storage until required.

The progress made at Dehra Dun is discussed by N. C. Chatterjee (pp. 19–21). Of the Membracids, *Otinotus oneratus*, Wlk., appears to be one of the common species in the quantitative collections [*cf.* xxi, 132], but it is not present on four of the host-sandal combinations and occurs rarely on *Pterolobium*-sandal and *Scutia*-sandal, whereas *Coccosterphus tuberculatus*, Motsch., is abundant in all combinations except sandal-*Lantana*, from which it is absent. It is relatively more numerous on both host and sandal in diseased areas than in healthy ones. The relative abundance of various insects on three plots in North Salem is discussed. In view of the discovery by M. Sreenivasaya that the intensity of infestation of sandal as measured by scars is roughly proportionate to the incidence of the disease, it is stated that the most abundant scar-making species are the Jassids, *A. walkeri*, *P. nigrilinea*, Wlk., *M. albimaculata*, Dist., *Bythoscopus indicus*, Léth., and *Ledra mutica*, F., which together form about a quarter of the total number of Rhynchota present. Of the five species, *L. mutica* is the rarest ; it attacks healthy and diseased sandal and scars the shoots during oviposition.

Ritchie (A. H.). **The Coffee Stem Borer Problem.**—*The Planter*, i, no. 6, p. 14. Arusha, Tanganyika, February 1933.

The Lamiid, *Anthores leuconotus*, Pasc. (coffee stem-borer) has been found to breed in three native Rubiaceous trees in Tanganyika, *viz.*, *Oxyanthus speciosus*, *Randia* sp. and *Vangueria* sp.

Metalnikov, jr. (S. S.). **Actions des rayons solaires sur les spores de bactéries pathogènes pour les insectes.**—*C. R. Soc. Biol.*, cxii, no. 16, pp. 1666–1669, 4 refs. Paris, 1933.

It has been shown [*R.A.E.*, A, xix, 146] that the dry spores of bacteria pathogenic to *Pyrausta nubilalis*, Hb., preserve their vitality for months, if not years. Experiments were conducted in Egypt to test whether dry spores remained pathogenic to *Platyedra* (*Gelechia*) *gossypiella*, Saund. [*cf.* xx, 245] after long exposure to strong sunlight. Spores of *Bacterium cazaubon* isolated from *P. nubilalis* and (in the earlier experiments) of *B. ephestiae* no. 1 isolated from *Ephestia kühniella*, Zell., in Egypt in 1931 were exposed continuously to direct sunlight in petri dishes, open or having a glass cover raised at the edge for ventilation, for periods of 4 and 10 days between 4th and 26th June, when the temperature ranged from 14°C. [57·2°F.] to 56°C. [132·8°F.], with a mean of 27°C. [80·6°F.], and for periods of 6 and 20 days between 20th September and 10th October, with a range of 18°C. [64·4°F.] to 40°C. [104°F.] and a mean of 23°C. [73·4°F.]. To test the pathogenicity of the spores a suspension was prepared containing 15 mg. in 1 cc. of water. Healthy larvae of *P. gossypiella* were placed on cotton sprayed with about 0·6 cc. of this emulsion and injections of 0·01–0·02 cc. were made into others. All the injections were fatal, but the interval before death for *B. cazaubon* was prolonged from 3–4 hours to 14 hours by the 10 days' exposure and to 9½ hours by the 20 days' exposure, and for *B. ephestiae* from 2 to 8 hours by the 10 days' exposure. The interval before death by ingestion was prolonged from 18 to 23 and 21 hours in the corresponding experiments with *B. cazaubon*, after which, of 10 larvae, 1 and 5 respectively survived. In the experiment with *B. ephestiae* the interval was prolonged from about 7 to 27 hours, none of the larvae surviving. The

results of the shorter exposures to sunlight showed that the reduction in the pathogenicity of the bacteria was progressive, but so long as the spores remain dry it is obviously very slow. It was more marked when the dish was covered.

Metalnikov (S.) & Metalnikov, jr. (S. S.). **Utilisation des bactéries dans la lutte contre les insectes nuisibles aux cotonniers.**—*C. R. Soc. Biol.*, cxiii, no. 18, pp. 169–172, 1 ref. Paris, 1933.

Following laboratory tests [see preceding paper] with bacteria pathogenic to *Platyedra* (*Gelechia*) *gossypiella*, Saund., experiments were carried out in a severely infested cotton field near Cairo from 1st July to 30th October 1932. The bacteria used were *Bacterium ephestiae* from *Ephestia kühniella*, Zell., *B. gelechiae* no. 5, isolated from dead larvae of *P. gossypiella*, and *B. cazaubon*. The dry spores in powder form were mixed with water at the rate of 1–4 oz. to 2½ gals. with the addition of 4 per cent. of molasses, and sprayed on the plants two or four times at regular intervals at the rate of 196 gals. or less to the acre. The best results were obtained in plots treated with *B. ephestiae*, the infestation in them being reduced by about 50 per cent. as compared with the controls. A slightly smaller reduction occurred in plots sprayed with *B. cazaubon*, whereas *B. gelechiae* reduced the infestation by rather less than 40 per cent. Plots treated with an arsenical spray showed a reduction of only 18 per cent. Counts of the infested bolls and the estimation of the weight of harvested cotton and seeds, details of which are shown in a table, also gave data considerably in favour of *B. ephestiae*. Some evidence was obtained of a spread of the bacterial infection beyond the treated area.

Chorine (V.). **Observation sur une maladie microbienne des chenilles** (*Brithys* (*Glottula*) *pancratii* **Cyr.**).—*Arch. Inst. Pasteur Algérie*, xi, no. 1, pp. 19–23. Algiers, 1933.

After briefly reviewing the literature on diseases of insects, the author points out that although outbreaks have been produced artificially, they have never completely destroyed the injurious insects against which they were used.

In Algeria at the end of June, an outbreak of disease occurred among the second generation caterpillars of the Noctuid, *Brithys pancratii*, Cyr., which usually feeds on *Pancratium maritimum* on the sand dunes. More than 50 per cent. of the caterpillars were dead or apparently dying, and immediate examination of the body fluids of affected individuals revealed the presence in some of them of numerous coccobacilli, which were successfully cultured. Out of about 100 infected or apparently dead individuals brought to the laboratory, 90 per cent. recovered after some hours and began to move about and feed ; the body fluids of 12 of them were examined at the end of three days but bacteria were found in one only. Moreover, cultures of the body fluids of 10 caterpillars gave no growth. Only about 10 per cent. of the caterpillars died, the others recovering spontaneously, evidently owing to the fact that the atmospheric conditions in the laboratory were more favourable than those on the dunes. Thus the results of the use of diseases against insects in nature partly depend on the physiological state of the insect, which is related to a number of factors about which little is yet known.

Locusts. Instructions for dealing with Flying Swarms.—*Rhod. Agric. J.*, xxx, pp. 399–403. Also as *Bull. Minist. Min. Agric.*, no. 890. Salisbury, Rhodesia, May 1933.

Smoke screens are recommended to prevent locusts from alighting on crops. These can be produced by injecting waste oil into the exhaust box of an internal combustion engine [*R.A.E.*, A, xx, 69]. A chemical smudge can be prepared by filling three-quarters of a tin with thoroughly mixed saltpetre (30 parts), sulphur (12 parts), borax (8 parts) and coal tar (25 parts), and placing over this a ½-in. layer of priming mixture consisting of 2 parts of a mixture of saltpetre, sulphur and borax as above and 1 part of fine white sugar. In a pound tin this preparation will burn for 12 minutes. The following formula is also recommended : 5 gals. coal tar, 100 lb. sodium nitrate, 50 lb. sulphur and 25 lb. borax. This quantity is sufficient to fill 100 one pound tins, each of which burns for 15 minutes.

Vayssière (P.). **Le criquet pèlerin** (*Schistocerca gregaria* **Forsk.**) **aux Açores.**—*Bull. Soc. ent. Fr.*, xxxviii, no. 6, pp. 85–86, 2 refs. Paris, 1933.

Several adults of *Schistocerca gregaria*, Forsk., were captured on one day in the Azores in November 1932. They are believed to have crossed from Morocco, a distance of over 1,200 miles, during a period of south-easterly winds.

Vayssière (P.). **La mouche du cresson** (*Hydrellia nasturtii* **Collin** [**Dipt. Ephydridae**]) **et son parasite** (*Ademon decrescens* **Nees** [**Hym. Braconidae**]).—*Bull. Soc. ent. Fr.*, xxxviii, no. 6, pp. 86–87, 5 refs. Paris, 1933.

Ademon decrescens, Nees, has been found parasitising *Hydrellia nasturtii*, Collin [*cf. R.A.E.*, A, xvi, 426] on watercress in south-western France.

Hodson (W. E. H.). **Narcissus Pests.**—*Bull. Minist. Agric. Fish.*, no. 51, viii + 40 pp., 5 pls., 2 figs., 30 refs. London, June 1932. Price 1s. [Recd. May 1933.]

An account is given of the morphology, bionomics and control of the principal narcissus pests occurring in Britain, including the Syrphids, *Merodon equestris*, F., *Eumerus tuberculatus*, Rond., and *E. strigatus*, Fall. [*R.A.E.*, A, xv, 460 ; xix, 374 ; xxi, 125], and the mites, *Rhizoglyphus echinopus*, F. & R. [xvii, 21], and *Tarsonemus approximatus* var. *narcissi*, Ewing [xxi, 112]. A separate section deals with the hot water treatment of the bulbs, which if properly applied, destroys all pests in them. In a brief note on " yellow stripe," a virus disease of narcissus, it is suggested that it may possibly be transmitted by *Thrips tabaci*, Lind.

Sharga (U. S.). **Biology and Life History of** *Limothrips cerealium* **Haliday and** *Aptinothrips rufus* **Gmelin feeding on Gramineae.**—*Ann. Appl. Biol.*, xx, no. 2, pp. 308–326, 1 fig., 1 pl., 29 refs. London, May 1933.

An account is given of investigations carried out in Scotland during 1929–30 on the biology of *Limothrips cerealium*, Hal., and *Aptinothrips*

rufus, Gmel., as pests of graminaceous plants. The methods by which they were reared in captivity are described. The females of *L. cerealium* hibernate in various meadow grasses, and emergence depends on the temperature and sunlight, large numbers being found by 26th May in 1930. After feeding for a time, they migrate to wheat seedlings, where they feed and oviposit on the young leaves and the tender, developing ears, accompanied by the larvae as they hatch. Early in June all the wheat plants were heavily infested with adults and oviposition had begun. The eggs are laid singly in slits in the plant tissue and hatch in 10–13 days. The larval, prepupal and pupal periods occupy 13–17, 2–3 and 6–7 days respectively, the last two stages being found inside the leaf sheaths or florets, chiefly in August. The life-cycle from egg to adult requires 29–35 days. Adults of the new generation were first discovered in the field on 29th June. The males are wingless and apparently die after pairing, none being found after 14th October in the laboratory. The females fly in bright sunlight, however, and may be carried long distances by wind. They return to the grasses from the grown crop and from the corn bundles lying in the field after harvest. There appears to be only one brood a year.

Oviposition causes blotching of the leaves of wheat, and the feeding of the larvae and adults produces white patches on the leaves. The thrips also attack the growing ears inside the leaf-sheaths so that the individual florets fail to set seed. Similar damage is caused to oats but is less evident in the leaves ; the percentage of unset seeds in affected inflorescences is high.

A. rufus is present on various grasses throughout the year and has been found on oats, wheat and barley in the summer. It is sometimes numerous inside the leaf sheaths of young wheat seedlings, near the roots. The eggs are laid in slits over the surface of the leaves, and there are several overlapping broods in a season. The males are rare. Oviposition by the form with six-jointed antennae (*connaticornis*, Uzel) [*cf. R.A.E.*, A, xviii, 435] continues throughout the year, the percentage of gravid females being highest in May and lowest in November. The larvae were most numerous in the winter, less so in spring and least in autumn ; the pupae were found in varying proportions during most of the year. Eggs from the form with eight-jointed antennae (*stylifera*, Trybom) were only found in the summer up to July. In both forms one or two eggs were common in a single female, but as many as five were sometimes found. The forms generally occur separately, but occasionally together in various proportions. Their distribution and the ratio collected from the various localities are given, with the numbers of males, females and immature stages. Their relationship is discussed, and it is considered that they both include a sexual and parthenogenetic race and that since the forms are so closely allied, *stylifera* may, under certain conditions, give rise to *intermedia*, Pr., which has seven-jointed antennae, or to individuals observed by the author bearing one antenna with six and the other with eight joints.

A. rufus was attacked by *Trombidium* sp., the larvae of which appeared to suck out the fluid of the abdomen but otherwise did not seem to affect the hosts, as some of them contained mature eggs, and also by an internal Nematode [*Tylenchus aptini*, Sharga (xx, 488)], which caused sterility and death in some cases.

METCALFE (M. E.). **Some Cecidomyidae attacking the Seed of** *Dactylis glomerata* **L. and** *Lolium perenne* **L.**—*Ann. Appl. Biol.*, xx, no. 2, pp. 327–341, 6 refs. London, May 1933.

Grasses grown for seed are subject to attack by Cecidomyiids, and investigations were undertaken from June 1931 to determine the extent of infestation of cocksfoot (*Dactylis glomerata*) and perennial ryegrass (*Lolium perenne*) in Britain.

The following is almost entirely taken from the author's summary: Three species have been observed on experimental plots at Harpenden, *Contarinia dactylidis*, H. Lw., and *Dasyneura dactylidis*, sp. n., on *Dactylis glomerata*, and *C. lolii*, sp. n., on *L. perenne*. Both sexes of all three species are described. They have one brood a year and overwinter as larvae in the soil. *Dasyneura dactylidis* emerges between 21st May and 6th June, *C. dactylidis* between 3rd and 24th June and *C. lolii* between 31st May and 26th June. The damage is caused by the larvae, which feed on the ovary, singly in the case of the first-named species and collectively in that of the others. The Scelionid, *Prosactogaster tisias*, Wlk., parasitised 42·3 per cent. of *D. dactylidis* and 11·6 per cent. of *C. dactylidis*, and another Scelionid (*Inostemma boscii*, Jur.) and a Chalcid parasitised 0·75 per cent. of *C. lolii*.

It was not found possible to induce attack by *C. dactylidis* on *Festuca rubra* or *L. perenne*, or by *C. lolii* on *F. rubra*, *Dactylis glomerata* or *Alopecurus pratensis*, and it appears probable that these midges are specific to the grasses they infest. In a brief discussion of control methods, it is suggested that delaying the flowering of the grasses by grazing sheep or by clipping, or very early cutting to prevent the development of the young larvae, might prove effective.

BARNES (H. F.). **Studies of Fluctuations in Insect Populations. II. The Infestation of Meadow Foxtail Grass** (*Alopecurus pratensis*) **by the Gall Midge** *Dasyneura alopecuri* (**Reuter**) (**Cecidomyidae**).—*J. Anim. Ecol.*, ii, no. 1, pp. 98–108, 6 refs. Cambridge, May 1933.

In this paper, which is one of a series [*cf. R.A.E.*, A, xx, 484], an account is given of a study of the prevalence and dates of emergence of the Cecidomyiid, *Dasyneura alopecuri*, Reut., and its parasites, the Eulophids, *Aprostocetus caudatus*, Westw., and *Tetrastichus roesellae*, Nees, and the Scelionid, *Prosactogaster attenuata*, Hal., over a period of five years (1927–32). *D. alopecuri* prevents seed production in meadow foxtail grass (*Alopecurus pratensis*), samples of which were collected for study at Aberdeen in July and August and then kept at Harpenden throughout the following winter, spring and early summer. The methods are fully discussed and the results tabulated. The annual degrees of infestation estimated in two localities near Aberdeen represented crop losses of from 35 to 4 per cent. The annual percentages of parasitism in the same localities varied from 38 to 2·3 and from 5·3 to 0·7

Early emergences (May) of the Cecidomyiid are correlated with daily range of temperature, but later ones proceed rapidly and the temperature has less effect on the numbers. There were daily fluctuations in the relative numbers of the sexes. Light affected the time of day at which the adults, especially the females, emerged. If the larvae were subjected to warm temperatures, emergence occurred throughout the winter. The peak of emergence of *D. alopecuri* varied between 21st

May and 17th June and that of its parasites between 4th June and 1st July; the latter normally emerge in the third week after the midge, thus allowing the larvae to reach the stage of development most suitable for parasitism. In 1928, however, the crest of emergence of the parasites occurred a week before that of the midge, and this resulted in a low relative parasitism followed by a great increase in the number of midges emerging in the subsequent year. The date of emergence indicates the date before which the grass must not be allowed to flower if control is required.

Data on the sex ratio of *D. alopecuri* showed no significant variation, but there was a tendency for females to be in excess.

NICHOLSON (A. J.). **The Balance of Animal Populations.**—*J. Anim. Ecol.*, ii, no. 1, pp. 132–178, 11 figs., 28 refs. Cambridge, May 1933.

The following is largely taken from the author's summary of a discussion of the problem of the balance of animal populations, mostly relating to insects: The known relation of density of animal populations to environmental conditions indicates that populations are in a state of balance with their environment. For balance, it is essential that the action of a controlling factor should be governed by the density of the population controlled, and competition seems to be the only factor that can be governed in this way. Whatever the form of competition, there is for each species a particular density ("steady density") at which balance exists. This density is dependent on the characteristics of the species, the features of the environment and the nature of the interaction. Competition tends to cause the steady density to be reached and maintained. Climate and most kinds of animal behaviour cannot themselves determine population densities, but may influence the values at which competition maintains them.

Control of density by natural enemies produces oscillation even in a constant environment. With simple interactions, such as a specific entomophagous parasite and its host, the amplitude of the oscillation increases with time. The final result is either perpetual maintenance of oscillation with constant amplitude under constant conditions, or the population is broken into widely separated small groups, the positions of which change continually with time. In the first case, the densities fluctuate about their steady values, and in the second, the average densities are maintained much below them. With complex interactions, the amplitude of oscillation decreases with time, so that in a constant environment the densities eventually reach and remain at their steady values. Environmental conditions, however, are never constant and periodic changes, such as those of the seasons, tend to impress their period on interspecific oscillation. Consequently the oscillation produced by the interaction of animals should generally correspond in time with these periodic changes, but its violence is greater than could be produced by them alone. Environmental oscillation prevents decreasing interspecific oscillation from dying out. Irregular environmental fluctuations tend to cause corresponding irregularities in the densities, but owing to the delayed effects of interspecific oscillation, further irregularities in the densities are subsequently produced with no evident relation to environmental conditions.

General Review of Research Work, Entomology.—*Ann. Rep. East Malling Res. Sta. 1932*, xx, pp. 44–47. East Malling, Kent, May 1933.

The entomological work for 1932 is reviewed, including that dealt with in the following papers. Sprays of petroleum and tar-petroleum, applied in February at a concentration of 10 per cent. against the eggs of the fruit tree red spider [*Paratetranychus pilosus*, C. & F.], gave 40–80 per cent. control. The highest mortality was obtained with two sprays containing tar distillates and one containing petroleum alone.

Raspberries, loganberries and blackberries were attacked by the weevil, *Rhynchites aeneovirens*, Mrsh., which has apparently not hitherto been recorded as a pest of these plants.

Massee (A. M.). **Notes on Insect Pests and Mites in 1932.**—*Ann. Rep. East Malling Res. Sta. 1932*, xx, pp. 109–116, 2 pls. East Malling, Kent, May 1933.

Damage caused by pests in Kent in 1932 included injury to apples by *Phyllobius oblongus*, L. (brown leaf-eating weevil) and *P. maculicornis*, Germ. (green leaf-eating weevil), which were reported from four districts. Infestation by *Anthonomus pomorum*, L., was not very severe in 1932, but many more adults were collected from the trees at night than in the day. The adults on trees lightly dusted with derris were paralysed but not killed; many remained semi-paralysed for ten days and then recovered. A "temporary nocturnal migration" of larvae of *Hoplocampa testudinea*, Klug (apple fruit sawfly) was observed to commence soon after nightfall and to end just before dawn. The larvae frequently re-entered the fruits by the exit hole, but they often bored into sound apples and even migrated to new groups of fruit. Trees were dusted with derris at 8 p.m. on 22nd June, and sheets were placed under them and under controls. After four nights, more than 100 larvae were removed from the sheets below each dusted tree, whereas only an average of 23 were taken from below the controls. *H. flava*, L., was reported on plums. A second brood of *Cydia pomonella*, L., occurred in one district, attacking the apples late in the season when it was impossible to use arsenical sprays. *Argyresthia conjugella*, Zell., has recently attracted attention as an apple pest; the larvae tunnel into the fruit and cause internal breakdown. It has been suggested that apples are only attacked if berries of mountain ash [*Sorbus aucuparia*], which is the normal food-plant, are not available. Pupation takes place in the soil. Fifty per cent. of the apples from one orchard were damaged on the surface by larvae of the Tortricid, *Batodes* (?) *angustiorana*, Haw., large numbers of which were also found active in a cold store [*cf. R.A.E.*, A, xix, 619]. The larvae overwinter in the orchards, being often concealed under pieces of dead leaves, which are fixed securely to the stems and buds, or sometimes under ground-débris or in cracks in the stems. They become active again in spring. *Tetranychus telarius*, L. (hop red spider), was found hibernating in cracks and crevices in the tops of hop poles. Attempts were made to destroy it by treating the poles with white oil emulsion. In an orchard in which *Aphelinus mali*, Hald., had been liberated against the woolly apple aphis [*Eriosoma lanigerum*, Hausm.] in 1931, it was active again in 1932 but did not spread far. In another orchard in which it was liberated early in 1932, it spread

over an area of 2 or 3 acres, and the numbers of its host were considerably reduced. A colony established in another orchard several years before had apparently died out after the Aphids had almost all been destroyed, but in March 1933 a few parasitised Aphids were observed.

Specimens of *Magdalis barbicornis*, Latr., which is rare in Britain, were received from Jersey where it had caused considerable damage to pear trees in 1931. The adult weevils feed on the epidermis on the lower side of the leaves during May, June and early July, causing brown patches to appear over small areas ; sometimes punctures are made completely through the leaves. The larvae live in small cavities hollowed out under the bark, chiefly of the main stems and older branches, in which they hibernate.

Massee (A. M.). **Further observations on the Strawberry Tarsonemid Mite** (*Tarsonemus fragariae* **Zimm.**).—*Ann. Rep. East Malling Res. Sta. 1932*, xx, pp. 117–131, 3 pls., 38 refs. East Malling, Kent, May 1933.

The distribution and food-plants of *Tarsonemus fragariae*, Zimm., in Europe are briefly discussed, and an account of its life-history and control is given. In Britain, where it was first reported in February 1930 [*R.A.E.*, A, xviii, 521], it has only been found on strawberry ; it is widely distributed in England and also occurs in Scotland and South Wales. In the course of three seasons' experiments, it has not been induced to feed on *Cyclamen*, *Begonia* or raspberry, on which it has been recorded on the continent of Europe.

The mites continue to breed from spring till autumn, and there are several overlapping generations during the year. The males are much less common than the females, and parthenogenesis is suspected. Hibernation takes place in the adult female stage only, the hibernating mites being found in the crevices of the crowns of the plants, where they appear to be unaffected by moisture. The methods of dissemination are doubtful, but migration occurs along the runners from parent to daughter plants.

The damage caused to established plants and runners is briefly described [xix, 177], and a list is given of commercial varieties of strawberry susceptible to attack.

Experiments in control are discussed. Dusting established plants with sulphur, and dipping runners before planting in lime-sulphur, etc., or fumigating them with hydrocyanic gas did not prove effective, and the plants were severely injured by the fumigation. In 1931, two applications of 3 per cent. lime-sulphur containing 0·1 per cent. powdered spray gelatine were made on infested strawberries at a pressure of 120 lb. per sq. inch. The first application was made on 15th and 16th April, when the overwintering females were emerging but had not begun to oviposit, and the second on 29th April, when eggs were being laid freely, but before oviposition was general. The sprays did not damage the plants, and though they did not give complete control, the number of mites was considerably reduced. Preliminary experiments were also made on sterilisation with hot water in the field [*cf.* xix, 373], the method used being described. Twenty thousand plants in bags were placed in water at 111°F. ; the temperature fell to 109°F. at first, but was afterwards raised to 110°F. At the end of twenty minutes the temperature was 110·5°F. and the plants were removed ; they were in a healthy condition 3 months afterwards, showing the practicability of sterilisation on a large scale.

STEER (W.). **Two Apple Capsid Spraying Trials and some Notes on Spray Damage.**—*Ann. Rep. East Malling Res. Sta. 1932*, xx, pp. 132–140, 1 pl. East Malling, Kent, May 1933.

In spraying trials in Kent against *Plesiocoris rugicollis*, Fall. (apple Capsid) [*cf. R.A.E.*, A, xx, 551, 552] two mixtures, " A " (proprietary petroleum wash 7½ per cent. and proprietary tar distillate wash 6 per cent.) and " B " (proprietary tar-petroleum mixture 10 per cent.), and a proprietary petroleum wash (10 per cent.) were used in February 1931. To estimate the results, samples of leaf trusses were examined and the fruit was subsequently graded. The results are tabulated and show that although all sprays gave good control, mixture " A," and to a less extent " B," retarded the opening of the buds, caused the blossoms to be sparse and weak, and possibly reduced the crop yield.

In 1932, a light lubricating petroleum oil at 6 per cent. strength and a strained anthracene oil at 4 per cent. were used, alone or in combination. The characteristics of these oils are tabulated. When used alone, they were emulsified with oleic acid and caustic soda [*cf.* xix, 612]; in combination they were emulsified in the same way or with Bordeaux mixture (4 : 6 : 100). The sprays were applied on 16th and 17th February, at a pressure of 300 lb. per sq. in. The crop from trees in the centre of each experimental plot was graded, the number and weight of the apples were recorded, and the results tabulated. All the sprays containing petroleum oil gave good control. The tar oil did not reduce attack when used alone and did not affect the results obtained with the mixed spray. The method of emulsification also did not affect the results. Neither oil damaged the trees when used alone, but the mixed sprays caused very severe bud injury and reduced the crop yield.

In both years the sprays were also applied to strawberries, gooseberries and black and red currants in order to estimate the damage to undercrops. All the sprays, but particularly the tar oils, injured strawberries. Gooseberries were severely damaged by some of the tar oils, and only slightly by others (including the anthracene oil). None of the sprays affected black or red currants.

MALENOTTI (E.). **Contro la** *Cydia pomonella* **L.**—*Italia agric.*, lxix, no. 4, reprint 19 pp., 8 figs., 15 refs. Rome, April 1933.

It is usual in Italy to apply the first lead arsenate spray against *Cydia pomonella*, L., immediately after the apple petals fall, but it has been found that this is too early in the northern part of the country. When overwintered larvae from an orchard in Verona were kept under observation, the first pupae appeared on 9th May 1932 and the first adult on 14th May. Two peaks of adult emergence occurred, on 21st and 28th May. Meanwhile all the varieties of apple in the orchard had finished blossoming by 10th May. The best date for the first spray would therefore be at least 12 days after the petals have fallen. Owing to rainy weather the period of emergence extended over 48 days, but 4 sprays of lead arsenate (5 lb. to 100 gals.) reduced the infestation to 12 per cent. as compared with 73 per cent. on trees on which sprays were only applied against the second (overwintering) generation. It is suggested that breeding cages should be used for ascertaining the date of emergence of the first adults and that 4 or 5 applications of spray should be made at 8-day intervals, beginning on the 5th day after emergence has started on a large scale. If attack by *Hyponomeuta*

padellus, L., is expected, an application of the spray, or better of an arsenical dust, may be made immediately the petals have fallen. The author is doubtful of the advisability of using an arsenical on more mature fruits for the control of the second generation.

Bands should be applied against both generations and should be cleared of larvae and pupae at 10-day intervals in July and August. Very few beneficial insects were found in the bands. Barium fluosilicate proved ineffective as a spray, possibly owing to the rains, as it is not very adhesive. Considerable re-infestation of treated trees from untreated ones 30 yards away was observed.

Silvestri (F.). **Rapporto tra insetti di piante spontanee e piante coltivate. Lotta biologica contro piante dannose.** [The Relation to Cultivated Plants of the Insects of Wild Plants. The biological Control of Weeds.]—*Italia agric.*, lxx, no. 2, pp. 91–119, 14 figs. Rome, February 1933. [Recd. May 1933.]

In discussing the relation to cultivated plants of insects occurring on wild ones, examples are given of the clearing of wild plants and consequent destruction of their fauna having left crops exposed to attack by pests unchecked by beneficial insects. The second part of the paper deals with the use of insects for the biological control of noxious plants, such as prickly-pear (*Opuntia*).

Candura (G. S.). **Studi e ricerche sugl'Insetti viventi nelle Paste Alimentari. Contributi: 1–14.** [Studies and Researches on the Insects living in Macaroni and similar Foods.]—*Bol. Soc. Nat. Napoli*, xliv (1932), pp. 159–203, 1 fig. Naples, 25th February 1933.

This first contribution to a study of the insects living in macaroni and similar foods in Italy, which is based on five years' observations, deals with the bionomics of *Plodia interpunctella*, Hb., *Ephestia kühniella*, Zell., *Calandra oryzae*, L., *Sitodrepa panicea*, L., *Tenebroides mauritanicus*, L., *Silvanus surinamensis*, L., *Laemophloeus turcicus*, Grouv., *Tribolium confusum*, Duv., *T. castaneum*, Hbst. (*ferrugineum*, F.), *Tenebrio molitor*, L., *Scenopinus fenestralis*, L., *Arthrocnodax farinicola*, Barnes, *Liposcelis* (*Troctes*) *divinatorius*, Müll., and *Blatta orientalis*, L. Descriptions of the various stages and of the damage done are included, with notes on natural enemies.

Of the insects listed, the larvae of *S. fenestralis* feed on mites and various insects that attack farinaceous food-stuffs. They do not become numerous enough to be of value in biological control, however, as many of the adult flies die before ovipositing, owing to sugar, on which they feed, not being available. The larvae, which may also be found in mattresses, hair, feathers, etc., hibernate and pupate in the spring or early summer, the adults emerging about a week later. The larvae of the Cecidomyiid, *A. farinicola* [*cf. R.A.E.*, A, xvii, 652] also feed on mites in provisions. The latter, however, have been found attached to the bodies of the adult midges, which are possibly responsible for their spread. The Psocid, *L. divinatorius*, is found in dwellings and warehouses throughout the year. The duration of its life-cycle varies from one month in summer to 4 or more in winter. It is omnivorous, feeding on food-stuffs of all kinds, dried plant and insect specimens, microscopic preparations, etc.

Measures applicable to the control of all these pests include storage of macaroni in clean dry warehouses with screened windows at a temperature of not more than 11°C. [51·8°F.], and, if necessary, fumigation with carbon bisulphide. Special care should be taken when the pastes are set to dry, as the odour is then at its strongest and therefore most likely to attract insects.

KUTTER (H.) & WINTERHALTER (W.). **Untersuchungen über die Erbsenschädlinge im st. gallischen Rheintale während der Jahre 1931 und 1932.** [Investigations on the Pests of Peas in the Rhine Valley in St. Gall during 1931 and 1932.]—*Landw. Jahrb. Schweiz*, xlvii, no. 3, pp. 273–338, 60 figs., 7 refs. Berne, 1933. (With a Summary in French.)

An account is given of an investigation in 1931–32 on *Kakothrips pisivorus*, Westw. (*robustus*, Uzel) and *Contarinia pisi*, Winn., which are serious pests of peas grown for canning in the Canton of St. Gall, Switzerland. The pea-weevil, *Sitona lineata*, L., also occurs in this district but was not studied, as its bionomics are well known [*R.A.E.*, A, xix, 588]. All stages of *K. pisivorus* are briefly described [*cf.* iii, 279]. In 1932 the first adults were observed on 8th June, the first oviposition on 13th June and the last on 28th July. The eggs were usually laid in the stamen-sheaths. Not more than 4 were laid daily, but as many as 80 were found in a single stamen-sheath. Oviposition in the young pods, or in other parts of the blossoms or young shoots was rare. The egg stage lasted 5–10 days, and the first larval stage 8–9. The second-stage larvae remained on the plants for about 6 days and then began to seek their winter-quarters, usually at a depth of about 10 inches in loose soil or nearer the surface in firm soil. In 1931 up to 375 larvae per square yard were found at a depth of 16 inches. None was observed in meadow land adjoining the pea fields. In 1932 pre-pupae occurred from mid-May onwards, the pre-pupal and pupal stages lasting 4–8 and 6–9 days. The adults emerged within a few days, and the males, which were less numerous than the females, disappeared during June. The females, and probably the males also, have good powers of flight. No natural enemies were observed, but heavy rain destroyed numbers of the thrips.

Contarinia pisi had 2 generations a year, the first developing in June and the second beginning in mid-July. In each generation oviposition lasted about 3 weeks, the eggs being laid in batches of 20 or more, usually inside the blossoms or on young leaves or shoots. After about 4 days the larvae hatched and began to feed, the majority being found at the base of the ovaries. The infested blossoms and tender pods either died or yielded small, undeveloped peas. When mature the larvae form cocoons in the soil ; those of the second generation probably do not pupate till the spring. Up to 128 cocoons were taken per square yard at a depth of up to 3¼ inches. *C. pisi* was parasitised by the Scelionids, *Sactogaster pisi*, Först., *Inostemma boscii*, Jur., and *Leptacis tipulae*, Kirby, and the Pteromalid, *Pirene graminea*, Hal., but only *S. pisi* and *P. graminea* were common. *S. pisi* oviposited in the eggs of the Cecidomyiid, and its larvae were found in those of the latter in their cocoons up to the end of October, the percentage of parasitism being as high as 50. In June *P. graminea* was common on the pea blossoms, and as it appeared again in the second half of July, it seems to have two generations a year. Oviposition was not observed, but eggs resembling those of this Pteromalid were found in midge larvae, so that it is probably a larval parasite. Various experiments in control

were made, without success. They proved, however, that only cultural measures would be feasible. Crop rotation over an extensive area has now been made compulsory.

de Fluiter (H. J.) & Blijdorp (P. A.). **De "grauwe dennensnuitkever," *Brachyderes incanus* L., als ernstige vijand onzer naaldhoutboomen.** [*B. incanus* as a serious Pest of Conifers in Holland.]—*Tijdschr. PlZiekt.*, xxxix, no. 4, pp. 95–96. Wageningen, 1933.

The weevil, *Brachyderes incanus*, L., is becoming a serious pest of young pines in Holland, the adults feeding on the edges of the needles and giving them a serrated appearance. They also occur on birch, oak, beech, and even cherry [*cf. R.A.E.*, A, xx, 566], attacking the bast. The biology of this species, about which little is known, is being investigated.

Zacher (F.). **Die tierischen Samenschädlinge in Freiland und Lager. Spinnentiere, Käfer und Hautflügler.** [The Animal Pests of Seeds in the Field and in Storage. Arachnoidea, Coleoptera and Hymenoptera.]—*Wiss. u. Tech. Gartenb.*, Heft 5, viii+78 pp., 20 pls. Neudamm, J. Neumann, 1932. Price *Rm.* 4.

This first part of a work on pests of seeds deals with the coconut crab, *Birgus latro*, L., the flour mite, *Tyroglyphus* (*Aleurobius*) *farinae*, DeG., Coleoptera (pp. 3–66) and Hymenoptera (pp. 66–78). In the case of insects of economic importance, notes on their distribution, bionomics and control are included. Their identification is facilitated by brief particulars of differential characters assisted by numerous figures.

Ziegler (O.). **Beiträge zur Oekologie des Hafers. Ueber die Beziehungen des Hafers zu den ökologischen Faktoren Weihenstephans unter Berücksichtigung der Zusammenhänge zwischen Wachstumsverlauf und Fritfliegenschaden.** [Contributions to the Ecology of Oats. On the Relation of Oats to the ecological Factors at Weihenstephan, with Consideration of the Connection between the Course of Growth and Injury by the Frit-fly.]—*Landw. Jahrb.*, lxxv, no. 5, pp. 617–668, 10 figs., 59 refs. Berlin, 1932.

This paper describes field work done at Weihenstephan, Bavaria, over a period of 8 years (1924–30) on the relations between ecological factors and the growth of oats, which were chosen as the cereal least suited to local conditions. The report is chiefly of agricultural interest. As regards infestation by *Oscinella* (*Oscinis*) *frit*, L., it was found that mild weather in February is followed by important damage, whereas it is only slight after a cold February unfavourable to the fly. High air-humidity produces many mature panicles, but this production is hindered by tillering, which increases when the heart-leaves have been eaten by the larvae of *O. frit*.

Thiem (H.). **Beiträge zur Epidemiologie und Bekämpfung der Kirschfruchtfliege (*Rhagoletis cerasi* L.).** [A Contribution to the Epidemiology and Control of the Cherry Fruit-fly.]—*Nachr. Bl. deuts. PflSchDienst*, xiii, no. 5, pp. 33–35. Berlin, May 1933.

Confirmation was obtained in 1932 of the importance of *Lonicera tatarica* as a food-plant of *Rhagoletis cerasi*, L. (cherry fruit-fly) in

Germany [*cf. R.A.E.*, A, xx, 454]. Of 17,716 berries from 29 localities in all parts of the country 57·3 per cent. contained eggs of the fly. In 1932, berries of *L. xylosteum* were also commonly infested; this is ascribed to a late appearance of the flies when the cherries had already been picked. *Berberis vulgaris* was usually attacked by *R. meigeni*, Lw., and only occasionally by *R. cerasi*. Other food-plants of the latter observed were several species of *Lonicera* and *Prunus padus*. The importance of the wild cherry needs investigation. As a rule the fruits were free from infestation, but in some cases 50 per cent. were attacked. In view of many reports of infestation, however, the eradication of wild cherry is considered essential for control of the fly.

The timing of bait-sprays is complicated by differences in the course of pupal development in the soil. Under otherwise similar conditions the flies emerged earlier from sandy soil and from the southern slopes of hills; in hilly areas this involves several applications of spray instead of only two or three. It would appear that *R. cerasi* occurs throughout Germany on *L. tatarica*, which has recently been extensively planted in towns. It is not, however, a pest in North Germany in the cherry orchards on the Lower Elbe, though it is abundant in the towns.

Stellwaag (F.). **Bekämpfung der Kirschfruchtfliege.** [The Control of the Cherry Fruit-fly.]—*Anz. Schädlingsk.*, ix, no. 5, pp. 61–65, 1 diagr. Berlin, May 1933.

Suggested methods of controlling the cherry fruit-fly [*Rhagoletis cerasi*, L.] in Germany comprise chemical measures, the complete collection of all infested cherries, and the picking of eating cherries while they are still hard, the latter measure being specially valuable. In 1932 experiments were made in various parts of the country with a variety of dusts and sprays, but the results obtained were so diverse as to be valueless, and further work is planned for 1933 under uniform conditions. Bait-traps proved unsuccessful, and soil-treatment impracticable.

Maercks (H.). **Wird der Wasserhaushalt der Insekten durch das Daltonsche Gesetz bestimmt?** [Is the Water-content of Insects determined by Dalton's Law?]—*Anz. Schädlingsk.*, ix, no. 5, pp. 66–68, 2 diagr., 4 refs. Berlin, May 1933.

Recent papers on the effects of humidity on insects are briefly reviewed [*cf. R.A.E.*, A, xix, 268 (also in B, xix, 101); B, xx, 181; A, xxi, 2], and an account is given of the results of work on the influence of saturation deficiency and relative humidity on mortality of the eggs of *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.), a parasite of the flour moth [*Ephestia kühniella*, Zell.]. The lowest temperature at which 100 per cent. hatching was attained was 18°C. [64·4°F.] with a saturation deficiency of 3 mm., the highest being 33·6°C. [92·48°F.] with a saturation deficiency of 8 mm. A deficiency of 3 mm. at 18°C. is equivalent to 80·6 per cent. relative humidity; and one of 8 mm. at 33·6°C. to 79·4. This means that the widest temperature zone for 100 per cent. hatching occured at the relative humidity of about 80 per cent., but not at the same saturation deficiency. Relative humidity and not saturation deficiency thus determined the temperature limits for a given mortality of the eggs of *M. hebetor*, and this applied also to the duration of embryonic development. According to Buxton the loss of water from the body of an insect at a given temperature appears to be proportionate to the saturation deficiency, *i.e.*, it follows Dalton's

law (except at the wet and dry ends of the scale). If this were so for *M. hebetor*, the mortality of the eggs would have been proportionate to the saturation deficiency, but such was not the case. This finding confirms Leeson's results with unfed rat fleas [B, xx, 181] and amplifies them by showing that mortality is directly connected with relative humidity. It would seem that processes involved in loss of water by living insects are too complex to be expressed by a simple physical law.

MAERCKS (H.). **Der Einfluss von Temperatur und Luftfeuchtigkeit auf die Embryonalentwicklung der Mehlmottenschlupfwespe** *Habrobracon juglandis* **Ashmead.** [The Influence of Temperature and Air Humidity on the embryonic Development of the Flour Moth Parasite, *Microbracon hebetor*, Say.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 347–390, 18 figs., 21 refs. Berlin, March 1933.

In these investigations, some of the results of which have been noticed above [see preceding abstract], about 12,000 eggs of *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.), were used at temperatures from 12°C. [53·6°F.] to 38°C. [100·4°F.] and at relative humidities of 4, 32, 76, and 98 per cent. The limits for egg development were 12 and 38°C. at 76–98 per cent. humidity, 12 and 37·7°C. [99·86°F.] for 32 per cent., and about 13°C. [55·4°F.] and 36·5°C. [95·9°F.] for 4 per cent. Development was most rapid at 33·5°C. [92·3°F.] for 32–98 per cent. relative humidity, and at 32·5°C. [90·5°F.] for 4 per cent. The optimum temperature was about 29°C. [84·2°F.]. The optimum relative humidity was about 80 per cent. [*loc. cit.*]. Duration of development depended chiefly on temperature and only slightly on humidity. The effect of temperature at an almost optimum humidity of 76 per cent. on the shortest durations may be very accurately represented by a catenary curve. The duration of development of the egg was not materially influenced by humidity, but retardation due to low temperatures was reinforced by low degrees of humidity. Under the combined influence of optimum temperature and optimum humidity all the larvae hatched almost simultaneously; under other conditions some larvae hatched first and were then followed by the majority. In the zone of optimum humidity the effect of temperature was as follows : an egg mortality of 100 per cent. at the the lowest temperature limit decreased to zero with a rise of only 6°C. [10·8°F.] and remained at zero until with a high temperature it rapidly rose to 100 per cent. at the upper temperature limit. At the optimum temperature egg mortality was not influenced by humidity. At other temperatures mortality was increased, first by low humidities and then by high ones. The effect of low humidities was more marked than that of high ones, and the effect of humidity was more marked at low temperatures than at high ones. High temperatures produced increased mortality more quickly than low ones.

JANISCH (E.) & ABDEL AZIZ ALI ELSAYED GHABN. **Ueber den Einfluss der Luftfeuchtigkeit auf die Entwicklung junger Seidenraupen.** [On the Influence of Air Humidity on the Development of young Silkworms.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 245–257, 8 figs., 15 refs. Berlin, March 1933.

The influence of air humidity on the mortality and duration of development of young larvae of *Bombyx mori*, L., was observed at

13°C. [55·4°F.], 22°C. [71·6°F.], 27·5°C. [81·5°F.] and 34°C. [93·2°F.]. At 22°C. the two extremes of air humidity at which the same mortality occurred were more widely separated than at any other temperature, thus proving this to be the optimum temperature. This agrees with the experience of silkworm breeders. A relative humidity of 90 per cent. was the optimum, with the widest extremes of temperature for a given mortality, and relative humidity, not saturation deficiency, was the factor involved. This observation with the larva of *B. mori* confirmed Maercks' finding with the eggs of *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.) [see preceding abstracts]. The effect on duration of development, moulting, and death at various air humidities and temperatures is shown in a series of curves and expressed in mathematical formulae.

Janisch (E.) & Maercks (H.). **Ueber die Berechnung der Kettenlinie als Ausdruck für die Temperaturabhängigkeit von Lebenserscheinungen.** [On the Calculation of the catenary Curve as an Expression of the Dependence of vital Phenomena on Temperature.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 259–268, 2 figs., 7 refs. Berlin, March 1933.

This is a discussion of the catenary curve, as used in the representation of biological reactions. As examples, symmetrical and asymmetrical curves are calculated for the development of the eggs of the flour moth [*Ephestia kühniella*, Zell.] and *Microbracon hebetor*, Say (*Habrobracon juglandis*, Ashm.), respectively.

Janisch (E.). **Untersuchungen über die Oekologie und Epidemiologie der Nonne. I. Die Abhängigheit der Entwicklungsdauer von Temperatur und Luftfeuchtigkeit.** [Investigations on the Ecology and Epidemiology of the Nun Moth. I. The Dependence of the Duration of Development on Temperature and Air Humidity.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 269–290, 8 figs., 24 refs. Berlin, March 1933.

This investigation, which is the first of a series based on modern methods of research on the biology of insects, aims at applying to the nun moth [*Lymantria monacha*, L.] in Germany the knowledge acquired in that research. The object is to ascertain the physiological relation of an insect to natural conditions, by reference to the reactions of the species under controlled conditions, so as to permit of predictions regarding its course of development, feeding, mortality, reproductive capacity, resistance to poisons, etc. The general principles to be followed in examining the effect of climate are discussed. Instead of regarding laboratory experiments as an aid to observations difficult to make in the field, the method of causal analysis determines experimentally the reactions characteristic of a species (*e.g.*, duration of development and mortality at various temperatures and air humidities) and uses the data so obtained as a basis for predicting its behaviour in nature, including numerical increase and decrease. The most important factor in such laboratory experiments is constancy in temperature and air humidity. A breeding dish ensuring constant humidity and rooms with constant temperature are described. The effect of temperature and humidity on the beginning of the 4 moults of the nun moth larva and on the beginning of pupation are shown in a series of curves and discussed. It was found that the biological optimum for the nun moth

occurred a little above 20°C. [68°F.] and between 80 and 90 per cent. relative humidity. The relation between temperature and duration of development was well represented by a catenary curve.

Beling (I.). **Zur Biologie und Zucht der Schlupfwespe** *Angitia armillata* **Gr. (Hym. Ichneum. Ophion.)** [The Biology and Breeding of the Hymenopterous Parasite, *A. armillata* Grav.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 237–244, 1 fig., 3 refs. Berlin, March 1933.

Several successive generations of the Ichneumonid, *Angitia armillata*, Grav., which is an endoparasite of the larvae of various Microlepidoptera, were reared on *Ephestia kühniella*, Zell., in the laboratory. Parthenogenetic reproduction produced males only, and about 80 per cent. of the adults reared in these experiments were males. The bionomics of *A. armillata* were very similar to those of *Nemeritis canescens*, Grav. [*R.A.E.*, A, xx, 491]. Mature larvae were found about 14 days after oviposition in *E. kühniella*, and the pupal stage lasted 14–20 days. Females that had opportunities for pairing and oviposition and were fed on honey lived for 8–16 days. Unmated females without a host lived for an average of 4·7 days with a maximum of 8, the corresponding figures for unmated males being 5·8 and 8. Pairing is described in detail. Only one parasite emerged from each larva of *E. kühniella*, irrespective of the number of eggs laid in it. When 1 female and 2 males were placed with 40 larvae of *E. kühniella*, the number of offspring produced varied from 1 to 30.

Jancke (O.). **Ueber den Einfluss der Kalidüngung auf die Anfälligkeit der Apfelbäume gegen Blutlaus, Blattlaus und Mehltau. Zugleich II. Mitteilung zur innertherapeutischen Schädlingsbekämpfung.** [On the Influence of Potash Manure on the Susceptiblity of Apple Trees to Attack by the Woolly Aphis, Leaf Aphis and Mildew. Communication II on the Control of Pests by the internal Treatment of Plants.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 291–302, 15 refs. Berlin, March 1933.

In experiments in southern Germany, which are described in detail, potash manure had no effect on infestation of apple trees by the woolly aphis [*Eriosoma lanigerum*, Hsm.] or by *Aphis* (*Doralis*) *pomi*, DeG. The Northern Spy variety was usually only slightly attacked by the woolly aphis. Potash manure produced increases in growth generally proportionate to the quantities used.

Jancke (O.). **Gibt es eine Ueberwinterungsform der Blutlaus?** [Is there an overwintering Form of the Woolly Aphis?]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 303–308, 2 figs., 5 refs. Berlin, March 1933.

Investigations begun in Germany in 1926–27 on *Eriosoma lanigerum*, Hsm., led the author to examine the question of the occurrence of a winter form as recorded by Mordvilko and Marchal in papers already noticed [*R.A.E.*, A, xiii, 69; xvii, 118]. He failed to find such a form, and states that the anomalies in the antennae considered to be typical of it occur also in the summer form and are due to scarcity of food or to weather influences.

Börner (C.) & Schilder (F. A.). **Ueber das bisherige Auftreten der Blattgallenreblaus in Deutschland.** [On the Occurrence of the Leaf-gall *Phylloxera* in Germany up to the Present.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 3, pp. 325–346, 4 figs., 21 refs. Berlin, March 1933.

For over 50 years following the discovery of *Phylloxera* in Germany in 1874 only the root forms and the winged individuals derived from them were observed in the field. The forms living in leaf-galls were not found until 1927, when they were observed in an experimental plot at Naumburg. A few other records have been obtained since. These are discussed in detail, with notes on climatic and other local conditions. At Naumburg the first generation of the leaf-gall *Phylloxera* appeared about May and there were up to 5 generations. As climatic conditions in Germany do not seem to inhibit the occurrence of this form in the vine-growing districts, all possible measures should be taken until vines susceptible to leaf-infestation are replaced by resistant varieties.

Kranche (O.). **Die Wachsmotten sind die ärgsten Schädlinge des Bienenstaates.** [The Wax Moths are the most serious Pests of Bee Colonies.]—*Ent. Rdsch.*, 1, no. 10, pp. 140–142.

Röber (J.). **Schlusswort zur Frage "Sind die Wachsmotten Schädlinge?"** [Final Word on "Are the Wax Moths Pests?"]—*T.c.*, pp. 142–144. Stuttgart, 15th May 1933.

The first of these papers on whether the wax moths, *Galleria mellonella*, L., and *Achroia grisella*, F., are pests or not [*cf. R.A.E.*, A, xxi, 323] gives the replies to the question from 5 societies in Germany interested in bee cultivation and representing some 200,000 beekeepers. All are very emphatic that these moths are serious pests.

The author of the second paper takes the view that the value of these moths as scavengers is so great that bees would cease to exist without them.

[Shtakel'berg (A. A.).] Stackelberg (A. A.). **Штакельберг (А. А.).** Ed. **Verzeichnis der schädlichen Insekten der Paläarktischen Region. Teil I. Schädlinge der Landwirtschaft.** [List of injurious Insects of the U.S.S.R. and adjacent Countries. Part I. Pests of Agriculture. (*In Russian.*)]—*Bull. Plant Prot.*, (1, Ent.) no. 5, xx + 500 pp., many refs. Leningrad, Lenin Acad. Agric. Sci. U.S.S.R. Inst. Plant Prot., 1932. (With an introductory Note in German.) [Recd. May 1933.] Price 13 *rub.*

This work, to which 15 specialists have contributed, represents the first part of a planned series of exhaustive and annotated lists of injurious animals that occur in the Russian Union or might be introduced into it, and is devoted to agricultural pests recorded from the Union, the whole of Europe, northern China and Japan, northern Africa, Turkey, Palestine, the Arabian States and Persia. It deals with over 3,000 species, which are divided into three categories, the first including pests of field crops, the second pests of orchards, small fruits and vines, and the third pests of stored products, fabrics, etc. The insects are arranged in systematic order, with notes on synonymy, distribution, food-plants, injurious stage, character of damage caused,

and in many cases economic importance, references to works on biology being also indicated for nearly every species. Indices to the Russian and scientific names of the insects and plants are appended.

Borchert (A.). **Zur Biologie der grossen Wachsmotte** (*Galleria mellonella*, **L.**). **I. Ueber Morphologie und Entwicklungsdauer der Larve der grossen Wachsmotte** (*Galleria mellonella* **L.**). [On the Biology of the large Wax Moth. I. The Morphology and Length of Development of the Larva.]—*Zool. Jahrb.*, Abt. Anat., lvii, no. 1, pp. 105–115, 6 figs., 5 refs. Jena, 4th May 1933.

Of 28 larvae of *Galleria mellonella*, L., 19 had 8 instars, 8 had 9 and 1 had 10. Observations of 24 larvae showed that the time of development from hatching to adult emergence averaged 62·5 and 65 days for those with 8 and 9 instars respectively and lasted 64 days for the larva with 10 instars. The cocoon-spinning stage averaged 10 days, and the pupal stage 8. Measurements are given of the head capsule, prothorax and body-length of larvae at various stages.

Appel (O.). **Atlas der Krankheiten der landwirtschaftlichen Kulturpflanzen. Dritte Reihe.** [Atlas of the Diseases and Pests of cultivated agricultural Plants. Third Series.]—31 × 45 cm., 11 col. pls. with text 29 pp. Berlin, P. Parey, 1933. Price, in Portfolio, *M.* 10.

These plates, painted from nature by A. Dressel, give an accurate representation of the injuries and of the developmental stages of the agents responsible. Two plates deal with insects, *viz. Cephus pygmaeus*, L., and *Chlorops taeniopus*, Mg., on cereals. The accompanying explanatory text includes brief notes on their bionomics and control.

de Fluiter (H. J.). **1. Voorloopige mededeeling van enkele resultaten, verkregen bij een onderzoek, ingesteld naar de parasieten fauna tijdens eene gradatie van** *Stilpnotia salicis* (**L.**) **te Wageningen. 2. Korte mededeeling over de biologie van** *Microcryptus subguttatus* **Grav., het belangrijkste parasietische hymenopteron van** *Diprion pini* (**L.**). [1. A preliminary Communication on some Results obtained in an Investigation on the Parasite Fauna of *S. salicis* during an Outbreak of the latter at Wageningen. 2. A brief Communication on the Biology of *M. subguttatus*, the most important Hymenopterous Parasite of *D. pini*.]—*Tijdschr. Ent.*, lxxvi, no. 1–2, pp. viii–xi. Amsterdam, May 1933.

During an outbreak of *Stilpnotia salicis*, L., on poplars at Wageningen the parasites obtained from it were the Braconids, *Petalodes* (*Rhogas*) *unicolor*, Wesm., *Meteorus versicolor*, Wesm., and *Apanteles solitarius*, Ratz., the Scelionid, *Telenomus nitidulus*, Thoms., the Encyrtid, *Copidosoma boucheanum*, Ratz., and the Tachinids, *Carcelia gnava*, Mg., *Pales pavida*, Mg., and *Compsilura concinnata* Mg. Of these *P. unicolor*, was itself attacked by *Eurytoma appendigaster*, Swed., the Pteromalid, *Dibrachys* sp., probably *cavus*, Wlk. (*boucheanus*, Ratz.), *Habrocrytus emerus*, Ratz. [*sic* ? *Habrocytus eucerus*, Ratz.], and *Mesochorus marginatus*, Thoms., *Meteorus versicolor* by the same parasites and also by *Eutelus* sp., the Torymid, *Monodontomerus dentipes*, Boh., *Eupelmus urozonus*, Dalm., and the Ichneumonid,

Hemiteles areator, Panz., *A. solitarius* by *E. appendigaster* and *Dibrachys*; and the three Tachinids by *Dibrachys*.

In a previous paper the author recorded the Ichneumonid, *Microcryptus subguttatus*, Grav., as a parasite of *Diprion pini*, L. [*R.A.E.*, A, xx, 659]. The larva lives inside the cocoon of the sawfly as an ectoparasite of the prepupa or pupa, and even of the adult. The female paralyses the host within its cocoon and then deposits an egg on the inner surface of the cocoon, the larva hatching in about 3 days.

de Meijere [J. C. H.]. **[The Emergence of the Adult of** *Diplostichus tenthredinum* **from the closed Cocoon of** *Diprion pini*.]—*Tijdschr. Ent.*, lxxvi, no. 1–2, pp. xxii–xxiii. Amsterdam, May 1933.

Referring to de Fluiter's discussion of the emergence of the Tachinid, *Diplostichus tenthredinum*, Br. & Berg., from the cocoon of *Diprion pini*, L. [*R.A.E.*, A, xxi, 186], the author draws attention to Hartig's suggestion (1837) that the exit for the adult parasite is perhaps prepared by the host larva after it has spun its cocoon.

Shibuya (M.). **On the Method of Mass-production of** *Trichogramma*, —*Proc. imp. Acad. Tokyo*, ix, no. 3, pp. 130–133, 1 fig. Tokyo. March 1933.

The technique employed in rearing *Trichogramma* on *Ephestia cautella*, Wlk., for the control of *Chilo simplex*, Butl., in Japan is described in detail. The larvae of *Ephestia* were fed on powdered soy-bean cake. The maximum daily number of parasites obtained was 500,000.

Kamito (A.). **On the Broad Bean Weevil introduced in Japan.**—*Proc. imp. Acad. Tokyo*, ix, no. 3, pp. 137–139. Tokyo, March 1933.

Bruchus rufimanus, Boh., though apparently of recent introduction into Japan [*R.A.E.*, A, xviii, 615], now occurs in all districts in which broad beans are cultivated. Observations on its bionomics are recorded [xix, 714]. Larvae may be found from May to September, pupae from June to October and adults from late July to early June of the following year. Oviposition occurs by day, and few eggs are laid at temperatures below 20°C. [68°F.].

For control of the Bruchids in stored beans the fumigants recommended are 1·5 lb. chloropicrin, or 5 lb. carbon bisulphide per 30 cu. m. [1,059 cu. ft.] with an exposure of 36–48 hours. About 50–80 per cent. of the Bruchids are killed by exposing the infested beans to the sun for more than 5 days [*cf.* xx, 573]. The Trichogrammatid egg-parasite *Uscana semifumipennis*, Gir., has been introduced from Hawaii for biological control and is now being bred in Japan.

Kaburaki (T.) & Iwasa (T.). **Notes on the Minimum and Optimum Luminosities causing the photic Response of the Rice Borer Moth.**—*Proc. imp. Acad. Tokyo*, ix, no. 3, pp. 140–142, 1 ref. Tokyo, March 1933.

Further experiments in Japan with *Chilo simplex*, Butl., confirmed previous ones [*R.A.E.*, A, xviii, 658] and showed also that the light-strengths of optimum attraction were 0·0131–0·0920 lux.

Querci (O.). **An Account of my Studies in the Biology of** *Pieris rapae*, **Linné. II.**—*Ent. Rec.*, xlv, no. 5, pp. 65–70. London, May 1933.

The author's observations on *Pieris rapae*, L., in Pennsylvania are further discussed [*R.A.E.*, A, xxi, 22].

Papers noticed by Title only.

Park (T.). **Studies in Population Physiology: The Relation of Numbers to initial Population Growth in the Flour Beetle** *Tribolium confusum* **Duval.**—*Ecology*, xiii, no. 2, pp. 172–181, 2 figs. Brooklyn, N.Y., 1932.

Park (T.). **Studies in Population Physiology. ii. Factors influencing initial Growth of** *Tribolium confusum* **Populations.**—*J. Exp. Zool.*, lxv, no. 1, pp. 17–42, 19 refs. Philadelphia, Pa., 5th April 1933.

Crowell (M. F.). **Oviposition of the Ichneumonid** *Itoplectis* [*Pimpla*] *conquisitor* **(Say) in a Larva of** *Pyrausta nubilalis* **Hübn.**—*Psyche*, xxxix, no. 4, p. 102. Cambridge, Mass., December 1932. [Recd. May 1933.]

Zappe (M. P.). **Control of the European Corn Borer** [*Pyrausta nubilalis*, Hb.].—*Circ. Conn. Agric. Expt. Sta.*, no. 92, pp. 45–49, 4 figs. New Haven, Conn., April 1933. [*Cf. R.A.E.*, A, xx, 701, etc.]

Friend (R. B.) & Hicock (H. W.). **The European Pine Shoot Moth** [*Rhyacionia buoliana*, Schiff., in Connecticut].—*Circ. Conn. Agric. Expt. Sta.*, no. 90, pp. 29–31. New Haven, Conn., March 1933. [*Cf. R.A.E.*, A, xxi, 233.]

Whitcomb (W. D.). **Relation of Temperature to the Development of the Plum Curculio** [*Conotrachelus nenuphar*, Hbst.] **in Apples** [in Massachusetts].—*J. Econ. Ent.*, xxvi, no. 2, pp. 415–419. Geneva, N.Y., April 1933. [*Cf. R.A.E.*, A, xx, 646.]

Felt (E. P.). **The Beech Scale** [*Cryptococcus fagi*, Bär.] **and a Fungus** [*Nectria coccinea*].—*J. Econ. Ent.*, xxvi, no. 2, p. 510. Geneva, N.Y., April 1933. [*Cf. R.A.E.*, A, xx, 282; xxi, 167.]

Dustan (A. G.). **The Gladiolus Thrips** [*Taeniothrips gladioli*, Moult. & Stnw.] **and its Control.**—*23rd–24th Ann. Rep. Quebec Soc. Prot. Pl.*, pp. 32–37. Quebec, 1932. [Recd. May 1933.] [*Cf. R.A.E.*, A, xxi, 287.]

Dustan (A. G.). **The Control of the imported Onion Maggot** [*Hylemyia antiqua*, Mg.].—*Circ. Dept. Agric. Canada*, no. 88, 4 pp., 2 figs. Ottawa, March 1933. [*Cf. R.A.E.*, A, xviii, 536.]

de Azevedo Marques (L. A.). **Vespa versus lagarta. Biologia da vespinha** *Protapanteles marquesi* **Brèthes, inimiga natural da borboleta diurna** *Papilio anchisiades capys* **Hübner.** [The Biology of *P. marquesi*, a Parasite of *P. anchisiades capys* in Brazil.]—2nd edn., 13 pp., 2 pls. Rio de Janeiro, Minist. Agric., Inst. biol. Def. agric., 1932. [See *R.A.E.*, A, xii, 224.] [Recd. May 1933.]

Jack (R. W.). **The Lesser Tobacco Wireworms** [*Trachynotus*].—*Bull. Minist. Agric. Lds.* [*S. Rhodesia*], no. 847, 6 pp., 1 pl. Salisbury, Rhodesia, March 1932. [Recd. May 1933.] [See *R.A.E.*, A, xx, 331.]

Meyrick (E.). **Exotic Microlepidoptera, iv, pt. 12** [including the Pyralid, *Melissoblaptes fructivora*, sp. n., bred from fruits of *Elaeis guineënsis* in Malaya].—pp. 353–384. Marlborough, Wilts, the author, April 1933. Price 3*s*. per part.

Tsumagari (H.). **List of injurious Insects** [42 species] **of Tobacco Plant in Japan.** [*In Japanese.*]—*Insect World*, xxxvii, no. 3, pp. 90–97. Gifu, March 1933.

Kuwayama (S.). **Studies on the Morphology and Ecology of the Rice Leaf-beetle,** *Lema oryzae* **Kuwayama, with special Reference to the Taxonomic Aspects.**—*Rep. Hokkaido Agric. Expt. Sta.*, no. 29, [*Japanese*] pp. 1–130, 8 pls. ; [*English*] pp. 1–132, 4 pls., 13 figs., 122 refs. Sapporo, Japan, December 1932. [See *R.A.E.*, A, xx, 459.]

Nakazima (S.) & Furukawa (K.). **Bionomics and external Structures of** *Liparis* [*Porthetria*] *dispar*, **an Insect noxious to** *Livistona chinensis* **R. Br. (in the nature reserve, Aosima Island, about 200 yards from the mainland).** [*In Japanese.*]—*Bull. Miyazaki Coll. Agr. For.*, v, pp. 1–12, 2 pls. Miyazaki, Japan, 1933. (With a Summary in English.)

Takahashi (R.). **Some Aphididae from Corea (Hemiptera).**—*J. Chosen Nat. Hist. Soc.*, no. 15, pp. 78–80, 7 figs., 11 refs. Keijo, Korea, 1933.

Murayama (J.). **Notes supplémentaires à la Révision des Ipides et Platypides de Corée. II.**—*J. Chosen Nat. Hist. Soc.*, no. 15, pp. 14–20. Keijo, Korea, January 1933. [*Cf. R.A.E.*, A, xix, 338.]

Murayama (J.). **Etude sur les organes génitaux du mâle du genre** *Xyleborus*. [*In Japanese.*]—*J. Chosen Nat. Hist. Soc.*, no. 15, pp. 21–35, 2 pls. Keijo, Korea, January 1933. (With a Summary in French.)

Metcalfe (M. E.). **The Morphology and Anatomy of the Larva of** *Dasyneura leguminicola* **Lint. (Diptera).**—*Proc. Zool. Soc. Lond.*, 1933, pt. 1, pp. 119–130, 6 pls., 20 refs. London, March 1933.

Miles (M.). **Observations on Growth in Larvae of** *Plodia interpunctella* **Hübn.**—*Ann. Appl. Biol.*, xx, no. 2, pp. 297–307, 2 figs., 10 refs. London, May 1933.

Moreau (L.) & Vinet (E.). **Evolution de la Cochylis** [*Clysia ambiguella*, Hb.] **et de l'eudémis** [*Polychrosis botrana*, Schiff.] **dans un vignoble de l'ouest de 1911 à 1932. Peut-on prévoir l'importance des invasions ?**—*Ann. Epiphyt.*, xviii, no. 4, pp. 250–258, 5 graphs. Paris, 20th December 1932. [Recd. May 1933.] [*Cf. R.A.E.*, A, xx, 453.]

Hille Ris Lambers (D.). **Ueber das Umbetten alter Kanadabalsam-Präparate von Blattläusen.** [On the Removal of Aphids embedded in old Canada Balsam Preparations.]—*Anz. Schädlingsk.*, ix, no. 5, p. 70. Berlin, May 1933.

GÖRNITZ (K.). **Methoden zur Prüfung von Pflanzenschutzmitteln. IV. Neue Apparate und Methoden.** [Methods for Testing Insecticides and Fungicides. IV. New Apparatus and Methods.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 46, pp. 1–59, 26 figs., 19 refs. Berlin, April 1933.

This, like the two following papers, forms part of a series dealing with tests of various properties of insecticides and fungicides [*cf.* *R.A.E.*, A, xiv, 193; xvii, 640; xxi, 180]. It is divided into five sections. In the first is described an apparatus that has been used with success for nearly 4 years and provides a much simpler method than those used by Campbell [xviii, 311] and Stellwaag [xix, 698] for determining the quantity of dust or spray on a given area of leaf. It also eliminates the element of error involved in the frequent determination of minute weights and makes it possible to apply any desired quantity of material. It consists of a cupboard divided into chambers. In one is a chemical balance, to one pan of which is attached a bar that projects through a slit in the dividing wall and supports a wire frame in the next chamber. The pan is counterpoised by a horizontal lever-arm with a sliding weight, so as to make the necessary allowance for the weight of the objects used. On the frame is laid a square of celluloid (in spraying experiments) or dark cardboard (in dusting). A weight is then put on the weight-pan, and the square is dusted or sprayed by means of an apparatus designed to distribute an exactly even coating over the whole area. As soon as the balance hangs even, the process is stopped. Thus, if the weight used be 0·1 gm. and the area of the square 625 sq. cm., the latter will have received a total coating of 0·1 gm., or 0·16 mg. per sq. cm., and any leaves or other flat objects laid on it, irrespective of shape or size, will be coated at the same rate. If the material is evenly distributed over the whole floor of the chamber, the objects need not be laid on the square (where their weight must be first allowed for), but the latter can be used simply as a sample area, like Campbell's cover-glasses. If the object be a branch naturally infested with insects and 0·2 gm. dust be distributed over a square of 400 sq. cm., the result should reproduce the effect of applying the customary 50 kg. per hectare [about 45 lb. per acre] to a forest surface.

In the second section, it is pointed out that laboratory tests of the resistance to rain of dust and spray materials have hitherto failed to reproduce the natural effect of relatively infrequent drops falling at irregular intervals over a long period. An apparatus is described in which a jet of water is partly intercepted by a horizontal lead screen, from which it falls in drops at a controllable rate, so that a "rainfall" of 5 mm. may be produced in 5 minutes or in over 2 hours. The resistance of different dusts could not be satisfactorily compared by this method, since it depended almost entirely on the nature of the first exposure to moisture, which acted partly as an adhesive, and this could not be repeated under identical conditions. Preliminary tests are described with coatings of different sprays applied to aluminium foil and exposed after drying to a "rainfall" of 5 mm. in 15 minutes. Resistance was measured by the formula $R = 100 \frac{B-F}{S-F}$, where F is the weight of the unsprayed foil, S that of the sprayed and B that of the foil exposed to the rain-bath. Bordeaux mixture (1 per cent.) had a resistance of 56, lime-sulphur (2·5 per cent.) and lead arsenate (0·5 per cent.) each of 52, calcium arsenate (0·5 per cent.) of 27, and lime-sulphur mixed with calcium arsenate of 29.

The resistance of Bordeaux was not appreciably lessened by a greater exposure (to 20 mm. over 1 hour). The resistance of washes containing lime-sulphur was much less when the coating had been exposed for some days in the laboratory before wetting. Results obtained by this method should be checked by field experiments and chemical analysis of residues.

The third section deals with fungicides. In the fourth, the author criticises the method of testing the toxicity of stomach-poisons by means of experiments with series of insects [xx, 57], on the ground that they assume that all the insects begin to feed as soon as the poisoned food-stuff is supplied. In fact, as illustrated particularly by an experiment with larvae of the nun moth [*Lymantria monacha*, L.], feeding may be delayed as long as 3 days, and totally different results would follow according to whether toxicity was reckoned by the number of days from the beginning of the experiment or from first feeding. It is therefore judged necessary to keep a record of each individual insect, and a technique is described that makes this possible with the minimum of labour. It was employed with second-instar larvae of the Phasmid, *Carausius morosus*, F., fed with poisoned leaves of *Tradescantia*. Those that, after several days, had not begun to eat, were eliminated as probably unhealthy. Those that had fed on the poisoned leaf were then supplied with an untreated leaf, so that it was possible to observe those that recovered. The cessation of feeding that follows a poison-meal is to be regarded as the effect of illness, not as evidence of a deterrent quality in the poison. Such a quality could be recognised if a large number of the insects abstained from the initial feed. Experiments with *L. monacha* and the weevil, *Hylobius abietis*, L., as well as *C. morosus*, suggested that insects that have almost or quite completed growth frequently stop feeding on a poisoned food-stuff before they have consumed a lethal dose.

The results of experiments with *C. morosus* on the toxicity of various arsenicals at different temperatures are given and compared with those obtained by Stellwaag [xviii, 525] and Berwig [xix, 614]. Sprays were applied at a dosage of 5 mg. per sq. cm. and a concentration of 0·15 As_2O_5, in the form of iron arsenate, calcium arsenate, lead arsenate or cadmium arsenate (in descending order of toxicity, except that above 20°C. [68°F.] lead arsenate dropped to the fourth place). At 9°C. [48·2°F.] the area of poisoned leaf eaten by the larvae was barely less than that of untreated leaf eaten by the controls (about 26 sq. mm.); at higher temperatures, while the daily feed of the controls rapidly increased (with a maximum of 54 sq. mm. at 22°C. [71·6°F.]), the amount of the poison-meal remained fairly constant, but the poison took effect much more rapidly. The mean survival period after iron arsenate was 126 hours at 9°C. and 26·4 hours at 26°C. [77·8°F.], the corresponding periods after lead arsenate being 166·8 and 38·4 hours.

The fifth section includes descriptions of an improved apparatus for collecting fallen excreta as an index of forest infestation [*cf.* xix, 702], and of a "copropgraph" (consisting of a funnel discharging on to a tin disk divided into 12 sectors and rotated by clockwork) for use in laboratory studies of excretion. It was found that maximum feeding and excretion of *Bupalus piniarius*, L., approximately coincided, the 6-hour intestinal period [xvii, 597] being irrelevant. This was confirmed also for *H. abietis*, and is assumed to be true for all species used in these studies. They were conducted normally at a

temperature of about 20°C. and a relative humidity of about 60 per cent. The excretion-curves of larvae of the sawfly, *Diprion* (*Lophyrus*) *pini*, L., and *Panolis flammea*, Schiff., showed no marked relation to time of day, but special experiments with *D. pini* showed a close relation to temperature. *B. piniarius* and *L.* (*Liparis*) *monacha* were shown to feed chiefly at night, but this habit could be reversed by artificial reversal of light and darkness. It was found, contrary to expectation, that an arsenical dust (at a dosage equivalent to 25 kg. per hectare [about 22 lb. per acre]) was more toxic to *L. monacha* when applied in the morning than in the evening, the mean survival periods being 83·6 and 131·5 hours. This may be simply because, in the latter case, the larvae were disturbed by the dusting during their main feeding-time, but it is possible that in their daylight feeding, when they appear to feed more on the surface of the pine-needles, they may actually ingest more poison. *H. abietis* was shown to feed chiefly about 7 a.m. and 6–7 p.m. and *C. morosus* chiefly by night, especially about 7 p.m., the excretion-curve of the latter corresponding very closely with the oviposition-curve of adults.

TRAPPMANN (W.) & NITSCHE (G.). **Methoden zur Prüfung von Pflanzenschutzmitteln. V. Beiträge zur Giftwertbestimmung und zur Kenntnis der Giftwirkung von Arsenverbindungen.** [Methods for Testing Insecticides and Fungicides. V. Studies on the Determination of Toxicity and the Toxic Effect of Arsenical Compounds.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 46, pp. 61–89, 3 figs., 22 refs. Berlin, April 1933.

Experiments are described on the toxicity of the customary arsenical sprays and fungicides, alone or in combination, to series and individuals of *Carausius morosus*, F. (2nd–4th instar) and *Bombyx mori*, L. (3rd–5th instar). Paris green was used at a concentration of 0·15 per cent.; lead arsenate (acid 86 per cent.: basic 14 per cent.) and calcium arsenate were used at an "unstandardised" concentration of 0·4 per cent. and a "standardised" one containing a percentage of As_2O_5 (nearly 0·1) based on the arsenic content of the 0·15 per cent. Paris green. The arsenicals alone generally gave 100 per cent. mortality; as judged by mean survival period, lead arsenate was the least toxic to *C. morosus*. Calcium arsenate, however, gave very low mortality of the silkworms (48–78 per cent.). Bordeaux mixture alone killed a considerable percentage of *C. morosus* (20 of the 4th instar and 97 of the 2nd) but with a very long survival period, and a larger percentage of silkworms (50–80) than the calcium arsenate, while lime-sulphur had little toxic effect. The toxicity of the arsenicals, especially to *C. morosus*, was generally much reduced by combination with Bordeaux, but less so with lime-sulphur, which actually increased that of lead arsenate to *C. morosus*. Later instars were generally more resistant, but since toxicity (at any rate to silkworms) depended largely on individual voracity, larvae were more liable to poisoning on the days immediately following a moult. It was also found that the toxicity of a particular compound varied with its content of As_2O_5, but that this factor cannot be used in comparing different compounds. The authors discuss the possible relation of toxicity to the stability of the compound used and to the pH-value of the intestines of the species. They conclude that there can be no "standard material" or "standard animal"; in the present state of knowledge,

toxicity can be inferred only from specific biological tests, the results of which cannot be accepted as valid except for the particular conditions of the experiment.

VOELKEL (H.). **Methoden zur Prüfung von Pflanzenschutzmitteln. VI. Nachwirkungen verschiedener Insektizide auf Seidenspinner.** [Methods for Testing Insecticides and Fungicides. VI. After-effects of various Insecticides on Silkworms.]—*Mitt. biol. Reichsanst. Land- u. Forstw.*, no. 46, pp. 91–94, 2 refs. Berlin, April 1933.

Experiments with silkworms [*Bombyx mori*, L.] confirmed the observation that the effects of an arsenical on the larvae of certain Lepidoptera are partly transmitted to their offspring [*R.A.E.*, A, xviii, 523]. Females that survived a dose, ingested in the last larval instar, of manganese oxide, magnesium oxide, copper oxide, derris powder, an arsenite or calcium arsenate laid a sub-normal number of eggs, including relatively few viable ones, and among the generation hatched from them there was a high mortality at all stages and the survivors in turn laid abnormally few eggs. It is thus important in toxicity tests to consider the ancestry of the individuals used.

REBMANN (O.). **Ueber ein neues Schädlingsbekämpfungsmittel (Fosfolon).** [A new Fumigant, Fosfolon.]—*Z. GesundhTech. u. Städtehyg.*, xxv, no. 5, pp. 279–284. Berlin, May 1933.

A description is given of laboratory and field experiments with mammals and insects to test the toxicity of a new German proprietary fumigant, Fosfolon, mainly composed of calcium phosphide (Ca_3P_2) and calcium carbide (CaC_2). When brought in contact with water or moist air, it generates acetylene and the intensely poisonous hydrogen phosphide gas. It was found to be cheap and effective against rodents, but no definite conclusion could be reached as regards insects, of which several different orders were tested.

ZWÖLFER (W.). **Studien zur Oekologie, insbesondere zur Bevölkerungslehre der Nonne,** *Lymantria monacha* **L. (Vermehrungspotential und Sterblichkeit der Entwicklungsstufen in ihren Beziehungen zu Temperatur und Luftfeuchtigkeit).** [Studies on the Ecology of the Nun Moth, especially on the Question of its Population. (The Potential of Increase and the Mortality of the developmental Stages in their Relation to Temperature and Air Humidity.)]—*Z. angew. Ent.*, xx, no. 1, pp. 1–50, 2 figs., 14 diagr., 69 refs. Berlin, April 1933.

A detailed account is given of experiments at Munich on the effect of climatic factors on *Lymantria monacha*, L. At air humidities between 50 and 100 per cent., the breeding of larvae at various temperatures influenced pupal weight and egg-production, both increasing with a rise in temperature until the weight of the female pupae and the number of eggs reached their maximum (about 500 mgm. and 150 eggs per female) at about 25°C. [77°F.], falling again with higher temperatures. A similar effect was observed as regards the percentage of females, which gradually rose to about 80 at 25°C., and it is suggested that the male larvae are more resistant to low temperatures and the female larvae to high ones. The connection between weight of female

pupae and subsequent number of eggs is of use in prediction of outbreaks. Larvae subjected to reduced humidity (under 17 per cent.) produced stunted pupae and adults.

The zone of lowest (5 per cent.) egg mortality during the development of the embryo was very extensive, ranging from 7 to 26·5°C. [44·6–79·7°F.], and including humidities between 0 and 100 per cent. With a rise in temperature the susceptibility to low humidity increased somewhat, and prolonged exposure to temperatures above 32°C. [89·6°F.] proved fatal at all humidities. Between 6 and 8°C. [42·8 and 46·4°F.] development of the embryo lasted 5 months (August–December), and at 10–12°C. [50–53·6°F.] about 7 weeks. These data on the great resistance of the egg were confirmed in the field. During the autumn transition period, the zone of vital optimum (below 5 per cent. mortality) remained considerable and resistance to low temperatures and low humidities was greater. During hibernation the prevention of hatching required temperatures under 6°C. [42·8°F.]. Data from the literature record the survival of eggs exposed to such low temperatures as —40°C. [—40°F.]. The optimum zone for hatching was restricted to temperatures between 10 and 23·5°C. [50 and 74·3°F.] and humidities between 70 and 100 per cent. The lowest temperatures at which hatching occurred were between 6·1 and 6·6°C. [about 43°F.], and the highest between 30·9 and 31·4°C. [about 88°F.].

The zone of favourable temperature for the first instar larva was comparatively narrow, lying between 15·5 and 25°C. [59·9 and 77°F.] and humidities of 80 and 100 per cent. Lasting exposure to over 33–34°C. [91·4–93·2°F.] or under 7·5°C. [45·5°F.] caused death. The first instar larva was most resistant to low humidity at 17–20°C. [62·6–68°F.]. The zone of lowest mortality in the second instar ranged from 10 to 31·5°C. [50–88·7°F.] and included humidities of 60–100 per cent., the greatest resistance to low humidity occurring between 15 and 20°C. [59 and 68°F.]. Lack of material restricted experiments with older larvae and pupae, but increased resistance to temperature and humidity was observed. From the point of view of subsequent egg-production, however, the zone favourable to the larva was comparatively narrow. While older larvae could utilise wide limits of temperature and humidity for their individual progress, the potential of increase of a population was confined within narrow limits. A considerable degree of warmth during the first larval instar and during the life of the mature larvae was necessary. These data agree with practical experience that unusually warm summers are followed by years with an increase of the moth.

Hofmann (C.). **Der Einfluss von Hunger und engem Lebensraum auf das Wachstum und die Fortpflanzung der Lepidopteren.** [The Influence of Starvation and restricted Space on the Growth and Reproduction of Lepidoptera.]—*Z. angew. Ent.*, xx, no. 1, pp. 51–84, 25 figs., 3 pp. refs. Berlin, April 1933.

The detailed experiments here described were carried out at Munich, using *Arctia caja*, L., and *Porthetria* (*Lymantria*) *dispar*, L. The effects of hunger were tested by both intermittent and absolute starvation of the larvae, and those of restricted space by placing equal numbers of larvae in containers of unequal size or *vice versa*.

The following is taken from the author's summary: Intermittent starvation greatly retarded the development of the larvae of both

species and decreased growth. Absolute starvation of almost mature larvae of *A. caja* accelerated metamorphosis. With absolute starvation, larval weight decreased more at 65 per cent. relative humidity than at 90 per cent., the larval stage lasting longer at 90 per cent. Intermittent starvation caused the death of 50–70 per cent. of the larvae of *P. dispar*. Newly moulted larvae were especially affected. Almost mature larvae of *A. caja* resisted absolute starvation better than those subjected to intermittent starvation from the third moult onward. Confined space checked the growth of the larvae of both species, and larval mortality was high. Larvae restored in their final instar to normal conditions showed a recuperation that also applied to the resultant adults. Starvation and restricted space reduced the number of eggs.

ANDERSEN (K. T.). **Der Einfluss der Umweltbedingungen (Temperatur und Ernährung) auf die Eierzeugung und Lebensdauer eines Insekts** (*Sitona lineata* **L.**) **mit postmetaboler Eientwicklung und langer Legezeit.** [The Influence of environmental Conditions (Temperature and Food) on Egg Production and Longevity of an Insect (*S. lineata*) with postmetabolous Egg Development and prolonged Oviposition Period.]—*Z. angew. Ent.*, xx, no. 1, pp. 85–116, 4 figs., 25 refs. Berlin, April 1933.

An account is given of experiments on *Sitona lineata*, L., in Bavaria from 1928 to 1931. The greatest number of eggs was laid at a more or less uniform temperature of 21–24°C. [69·8–75·2°F.] during the main oviposition period (June and July). Low temperatures at the beginning of the reproduction period checked oviposition and reduced the number of eggs laid, and the later the higher temperatures occurred, the less was their effect. Under 11°C. [51·8°F.] and over 26°C. [78·8°F.] egg production ceased within a few days. It began in spring when the daily average temperature approximated to 12°C. [53·6°F.] and a temperature of over 13°C. [55·4°F.] occurred in the course of the day. High temperatures of 30–32°C. [86–89·6°F.] were supported if the daily average remained below 25°C. [77°F.], but fertility, duration of oviposition, and longevity suffered. A variation in temperature made its effects felt within 24 hours. The daily variations in number of eggs were due to oviposition being more accelerated by increased temperature than egg-development. The average daily maximum of eggs laid was 49, with an absolute maximum of 85. As regards food, it was found that the weevils fed on the leaves of red clover ate less than those fed on bean leaves and laid fewer eggs. The duration of the pre-oviposition period of the adults depended on the date of emergence in summer or autumn and on the weather in the following spring. It was followed by a period of 2–3 months, or longer in captivity, during which egg-development and oviposition occurred. Temperatures above 26°C. [78·8°F.] or below 16°C. [60·8°F.] and defective feeding curtailed the reproductive period of the female. Death through age did not immediately follow the termination of sexual activity. Low temperatures lengthened, and high ones shortened life. In this connection temporary high temperatures were of greater importance than the height of the average temperature. Defective feeding shortened the life of the males markedly. In the case of the females it first prolonged it (on account of reduction in egg-production), but severe starvation soon caused death.

Borchers (F.). **Bemerkungen zu der Arbeit von Rudolf Geiger: "Meteorologische Beobachtungen bei der mittelfränkischen Kieferneulenbekämpfung mit Flugzeug und Motor im Jahre 1931."** [Remarks on R. Geiger's Paper: "Meteorological Observations during Work against the Pine Noctuid in Central Franconia in 1931 by Means of Aeroplane and Power Duster."]—*Z. angew. Ent.*, xx, no. 1, pp. 117–125, 4 refs. Berlin, April 1933.

Commenting on the opinion of Geiger that, owing to meteorological factors, dusts are less effectively applied against forest pests by a power duster than from an aeroplane [*R.A.E.*, A, xx, 490], the author does not consider this conclusion of universal application, since the physical composition of different dusts and the efficiency and method of work of different power units are variables. Geiger used a dust that was practically non-hygroscopic against the pine Noctuiid, *Panolis flammea*, Schiff. Using a calcium arsenate dust of a slightly hygroscopic nature, Schimitschek obtained excellent results against the same pest [xx, 713], showing that meteorological conditions act differently on different materials. The action of the power duster used by Geiger is not characteristic of all patterns, and if his conclusions were correct, power dusting would register failures or partial failures in all instances, whereas the majority of applications are successful.

Leach (J. G.). **The Method of Survival of Bacteria in the Puparia of the Seed-corn Maggot** (*Hylemyia cilicrura* **Rond.**).—*Z. angew. Ent.*, xx, no. 1, pp. 150–161, 9 figs., 16 refs. Berlin, April 1933.

In previous papers the author and other workers have demonstrated the part played by Diptera in the spread and development of the bacterial soft rots of plants. Recently the author reported the results of a study in Minnesota on the histological relations between *Phorbia* (*Hylemyia*) *cilicrura*, Rond., and its symbiotic bacteria in decaying potato tubers [*R.A.E.*, A, xviii, 219]. A description is given here of the method of survival of bacteria within the puparia as studied histologically. The bacteria survived in the lumen of the mid-intestine, in the cast-out linings of the fore- and hind-intestines, and in the space between the prepupal cuticle and the true pupa. In the mid-intestine the bacteria were reduced to a relatively small number, but they reappeared and multiplied rapidly before the imago emerged from the puparium.

Hoffmann (W. E.). **Observations on a Weevil injurious to Banana.**—*Hong Kong Nat.*, iv, no. 1, pp. 48–54, 5 figs. Hong Kong, April 1933.

A weevil, of which all stages except the egg are described and which is believed by the author to be a species of *Odoiporus* [probably *O. longicollis*, Ol.], has on several occasions recently been observed attacking the stems of bananas in Kwangtung. It occurs also in Hong Kong and Hawaii. It is readily bred under laboratory conditions, completing its life-cycle in about 6 weeks. In the field it breeds almost throughout the year, probably having several generations annually. Oviposition was not observed by the author nor were the eggs seen, but they are probably laid on or in the stem, particularly where it is diseased or injured, and possibly also in the terminal end of the plant among the unfolding leaf-sheaths. The larvae tunnel in the stem and pupate

there in cocoons made of the fibre of the food-plant. The attendant fermentation and decay rather than the actual feeding probably cause the chief injury to the plants. Attack is accompanied and followed by the presence of other insects. Development can be completed even on a piece broken from the plant. When the heart is attacked near the terminal end, the plant always dies. The most practical control consists in clean culture and trapping the adults by means of pieces of stem on which they will oviposit, but which are too thin for completion of development.

FRENCH (C.). **New Records of Plants attacked by Insects.**—*Vict. Nat.*, xlix, no. 11, p. 264.
FRENCH (C.). **New Records of Plants attacked by Native Insects.**—*T.c.*, no. 12, p. 296. Melbourne, 1933.

These two papers deal respectively with the Lymantriid, *Orgyia anartoides*, Wlk., and *Tortrix postvittana*, Wlk., in Victoria. The natural food-plant of these moths is *Acacia*, but both cause considerable damage in orchards and to garden and greenhouse plants. *O. anartoides* is very destructive to the fruit spurs, fruits and leaves of fruit trees, and also to cauliflower and cabbage.

The larvae of *T. postvittana* roll the leaves of apple, finally pupating in them, and also damage the fruit after storage.

Papers on the Physiology of the diseased and injured Plant. (Material for the Valuation of the Effectiveness of Measures against Pests and Diseases and of Estimation of Losses caused by them.) [*In Russian.*]—*Bull. Plant Prot.*, (3) no. 3, 147 pp., ill., 31 refs. Leningrad, 1933.

As a basis for determining the effect on the ultimate crop of the injuries caused to cultivated plants by insect pests, etc., the experiments described in this series of papers were undertaken in Russia in 1929 and 1930 to obtain data on the effects of the damage caused to cereals by mechanical lesions. In the first paper, " On the Coefficients of Injury " (pp. 3–14), V. N. Lyubimenko shows the importance of finding these coefficients, by means of which the effect on crop yield of a known amount of injury to the roots, stems or leaves of the plants is calculated [*R.A.E.*, A, xiv, 285], and discusses the experiments involved, with particular reference to the effects of mechanical injury to the leaf surface of cereals. The second paper (pp. 15–43), by Z. M. Eidel'man is entitled " The Effect of mechanical Reduction of the Leaf Area upon the Growth and Development of cultivated Plants in Connection with the Methods of counting Injuries from Diseases " and has a summary in English (p. 41). From 25 to 100 per cent. of the leaf surface of summer wheat plants of different stages of development and densities of sowing was removed, and the corresponding decrease in the quantity and quality of the grain is discussed. The two uppermost leaves proved to be of particular importance for the formation of grain, since their removal at the stage of tubing caused a reduction in its quantity and quality amounting to 39·1 and 21·2 per cent. respectively, somewhat lower figures being obtained when the leaves were removed at the initial stage of flowering.

The third, fourth and fifth papers (pp. 44–60, 61–64 and 65–72) comprise "An experimental Study of the Influence of the artificial Decrease of the Assimilative Area of Leaves on the Amount of Harvest," by V. Shevchenko ; "The Influence of artificial Decrease of the Area of Leaves on the Development of Summer Wheat at the Latitude of Kiev," by S. F. Telichko & E. A. Siryachenko ; and "Principal Results of Experiments on the artificial Reduction of the Leaf Surface in different Geographical Points," by Eidel'man (with a summary in English, p. 71). They deal with field observations conducted in two districts in the Kiev Government on oats and summer and winter wheat, and near Leningrad on summer wheat only, the principal conclusions reached including the following : In the Ukraine, a reduction of the leaf surface at the period of tillering or tubing retards the development of winter wheat by about two weeks. The removal of all leaves at the flowering period decreases the production of grain by 25 per cent., but the yield is not affected if the leaves are removed at the milk stage of ripeness. In oats, the reduction in yield of grain following injury during the early stages of development is much greater, and even at the flowering and milk stages the leaves of the lower zones are of considerable importance for the production of the grain, the removal of the oldest and lowest leaves reducing its weight by 17–20 per cent. Summer wheat grown near Leningrad was much more affected by the removal of leaves than that grown in the Ukraine.

The sixth paper, "The Effect of mechanical Reduction of the Leaf Surface on the Development of Plants, the Accumulation of Dry Substance and the Yield of Grain in Summer Wheat and Barley," by O. A. Shchegoleva & E. V. Chernuisheva (pp. 73–111, with a summary in German, p. 109), contains a detailed account of laboratory experiments in which round holes of different sizes were cut in the leaves of summer wheat and barley, from 5 to 30 per cent. of the leaf surface being thus removed. The effects of removing a given area of leaf surface were always more marked when the holes were small than when they were large, because the total perimeter of the lesions was larger. When 20–30 per cent. of the leaf surface was removed by holes 1·25 mm. in diameter, the leaves dried quickly and died within about three days. The mechanical injury to the leaf tissues accelerated the rate of gaseous interchange in respiration and photosynthesis up to a certain maximum, after which a decrease took place. If the total area and perimeter of the lesions were not too large, and particularly if the plants were injured at a later stage of development, the yield of grain and the quantity of dry substance were higher than in uninjured plants. A greater decrease in dry weight occurred in plants injured before tillering had started. The unfavourable effect of injury was greater, and the favourable effect less, in wheat than in barley. In all cases when there was a decrease in dry weight of the plants, it was accompanied by a greater decrease in the quantity and quality of the grain.

In the seventh paper, "The Effect of Mechanical Reduction of the Leaf Area and of different Alimental Conditions upon the Accumulation of Dry Stuff in Cereals" (pp. 113–130, with a summary in English, p. 129), Eidel'man & E. A. Bankul present details of investigations on barley grown in sandy soil with the addition of various chemical fertilisers. The removal of all leaves in the tubing stage did not retard the development of the subsequent stages, and

the final weight of the vegetative parts was reduced by only 29·1 per cent. as compared with 66·7 per cent. for wheat, the respective maximum losses in the weight of grain being 33·6 and 81·6 per cent. A reduction of the assimilative surface of the leaves by 50 per cent. increased the energy of photosynthesis of the remaining part of the leaf blade for a period of 9–14 days, after which the rate of assimilation decreased.

In the final paper, "The Physiological Value of the Leaves of different Ages in the different Stages of the Development of a given Plant" (pp. 131–146, with a summary in English, p. 145), the same two authors deal with experiments on summer wheat and soy bean plants to determine the energy of gaseous interchange in photosynthesis of the various leaves, the accumulation of soluble carbohydrates and dry substance during the day, and the rate of transpiration. Most of the results obtained were not conclusive, but in wheat it appeared that carbohydrates are most actively assimilated by the leaves of the fourth and fifth zones during the sagittal stage, whereas during the period of flowering the maximum of assimilation is exhibited by the leaves of the sixth zone. In these two stages, the older leaves of wheat transpire more intensely, whereas in the milk stage of ripeness all the leaves transpire equally.

Götzl (—). **Ein neuer Rebenschädling.** [A new Pest of Vine.]—*Verlautbar. deutsch. Sekt. mähr. Landeskult.*, 1932, no. 13–14, p. 112, Brünn. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 3, p. 61. Vienna, June 1933.)

In many localities in southern Moravia, particularly where the soil is sandy, vines have been injured by the Tenebrionid, *Opatrum sabulosum*, L. The larvae and adults feed on the swelling buds in the soil and destroy the young shoots, and the adults occasionally also attack the shoots above the ground. A spray of Urania green and Bordeaux mixture, thoroughly applied to all shoots above ground, is suggested for control.

Zpráva o význačných škodlivých činitelích kulturních rostlin v Československé Republice ve vegetačním období 1931-1932. [Report on important adverse Factors affecting cultivated Plants in the Republic of Czechoslovakia in the Vegetation Period of 1931–32.]—*Ochr. Rost.*, xiii, no. 1–2, pp. 7–56, 3 figs., 1 map. Prague, 1933.

This series of reports includes five by different authors on the diseases and pests of cultivated plants observed in Czechoslovakia in the year ending in the autumn of 1932, one, by C. Magerstein, on pests of basket willows, most of which have been noticed elsewhere [*R.A.E.*, A, xxi, 85, 216, etc.], and one, by A. Pfeffer, on forest pests. Of these the chief were the nun moth [*Lymantria monacha*, L.] and *Panolis flammea*, Schiff. (*piniperda*, Panz.), severe and extensive outbreaks of which occurred on spruce and pine respectively. In some localities an arsenical dust was applied with success against *L. monacha*. Collection of the adults [*R.A.E.*, A, xix, 702] is not considered of value in control, as pairing and oviposition chiefly occur high up in the trees and most of the moths that settle on the trunks have already laid their eggs. Aeroplane dusting against

P. flammea was carried out over an area of about 5,500 acres, and good results were obtained where a contact insecticide was used, an arsenical dust being much less effective.

TOMASZEWSKI (W.) & HASE (A.). **Ueber eine erfolgreiche Massenzucht von** *Trichogramma minutum* **Riley (Hymenoptera, Chalcidoidea).** [On a successful Mass-breeding of *T. minutum*.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 6, pp. 41–43, 5 figs., 4 refs. Berlin, June 1933.

An account is given of the mass-rearing of *Trichogramma minutum*, Riley, on eggs of *Ephestia kühniella*, Zell., in Berlin. The parasite material was obtained from the United States at the end of 1932 and 8 million parasites were available for use early in 1933 against the pine Noctuid [*Panolis flammea*, Schiff.] in Pomerania. To prevent any possible infestation of the hosts by *Nemeritis canescens*, Grav., *Pediculoides ventricosus*, Newp., etc., they were distributed in glasses of a capacity of about 4 pints. Batches of about 2,000 host-eggs were incubated in flour, the larvae from each batch being placed in a breeding chamber kept at 25°C. [77°F.] and containing about 4½ oz. of oat flakes. The adults were collected in glass tubes. Each colony of *E. kühniella* could be used for 5–6 weeks from the time of emergence of the first moths, after which the numbers and fertility of the moths decreased, and there was risk of infestation by the Gamasid, *Seius muricatus*, Koch, which feeds on the eggs. For oviposition 2,000–2,500 moths were placed in tin containers 3¼ inches high and 6½ inches in diameter, and the eggs were then collected from the bottom of the tin. Card disks about 1⅛ inch in diameter were painted on one side with a solution of shellac and laid on the eggs, which adhered as a uniform coating of about 3,000 per disk. The cards were then ready for exposure to *T. minutum* or could be kept for 10–12 days at 4–7°C. [39·2–44·6°F.]. For transport, 77 disks were pasted to a sheet of parchment paper stretched in a wooden frame. A number of frames could thus be stacked in a box without the cards coming in contact.

GOFFART (—). **Ueber ein Auftreten von** *Mermis nigrescens* **Duj. in Engerlingen von Maikäfern.** [On an Occurrence of *M. nigrescens* in Cockchafer Larvae.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 6, p. 43. Berlin, June 1933.

Many larvae of *Melolontha melolontha*, L. (*vulgaris*, F.) in the turf of a sports ground in Germany were found in the autumn of 1932 to be parasitised by a Nematode, *Mermis nigrescens*, but a considerable mortality among them observed in the spring of 1933 is ascribed to infection by a fungus and a bacterial disease.

LAUBERT (R.). **Die Raupe von** *Amphipyra pyramidea* **L. als Azaleenschädling.** [The Larva of *A. pyramidea* as a Pest of Azaleas.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 6, pp. 43–44, 2 figs. Berlin, June 1933.

A larva of the Noctuid, *Amphipyra pyramidea*, L., is recorded as attacking the leaves and flowers of a potted azalea. It was first observed in April and pupated in the soil of the pot in May, the adult emerging in June.

Korff (G.) & Böning (K.). **Der Meerrettichblattkäfer, seine Lebensweise und Versuche zu seiner Bekämpfung.** [The Horse-radish Leaf-beetle, its Bionomics and Attempts at its Control.]—*Prakt. Bl. Pflanzenb.*, xi, no. 3–4, pp. 93–100, 1 fig., 22 refs. Freising, 1933.

Much loss is caused to the horse-radish crop in Bavaria by the Chrysomelids, *Phaedon cochleariae*, F., *P. cochleariae* var. *neglectus*, Sahlb., and *P. armoraciae*, L. The eggs, larva and adult of *P. cochleariae*, which is the most common, are briefly described and notes are given on its bionomics [*cf. R.A.E.*, A, ix, 350; xx, 78]. The larvae, which at first live gregariously, feed on the lower surface of the leaves, preferring the central ones, or mine short galleries in the pedicels and veins. They mature in about 3 weeks and pupate in the ground at a depth of about 1–2 ins., the young adults emerging in 8–12 days. There are two overlapping generations a year.

As cultural measures, which are briefly reviewed, do not give complete control, laboratory experiments with sprays and dusts, most of which were proprietary, were carried out in 1931 and 1932. The insecticides were applied either directly to the beetles or to horse-radish leaves on which they were fed. All the arsenical dusts were almost equally effective, the beetles being killed in 1–2 days. Dusts containing nicotine or pyrethrum acted immediately; though some of the beetles were at first only paralysed, they died in 1–2 days. Of the sprays tested, the arsenicals gave unsatisfactory results, but preparations containing pyrethrum, derris or nicotine, and 5 per cent. barium chloride caused 100 per cent. mortality. Dusts are easier to apply in the field, though dry weather is probably required for their maximum effect. Those containing pyrethrum or nicotine are preferable, as they do not injure plants or leave dangerous residues on them.

Thompson (H. W.). **The Control of a Watercress Leaf-beetle** (*Phaedon cochleariae*).—*Welsh J. Agric.*, viii, pp. 233–236, 3 refs. Cardiff, January 1932. [Recd. June 1933.]

Serious damage was caused to watercress (*Nasturtium officinale*) in South Wales in 1930 by larvae and adults of *Phaedon cochleariae*, F. In addition to loss through leaf injury (estimated at ½ ton at one centre), the plants were entirely prevented from seeding by adult beetles, which clustered on the flowers during sunny weather while pairing was taking place. There were apparently two overlapping generations, and throughout most of the summer eggs, larvae and adults were present on the plants together. In April 1931 the beetles were at least as numerous as in the preceding year. Six or seven applications in May–June of a 1 per cent. pyrethrum spray or of a derris-soap spray gave effective control; by the middle of June the beetles were comparatively scarce, and injury to the plants was negligible and seeding normal. In another centre it was possible to flood the beds [*cf. R.A.E.*, A, xvii, 427, 675]. Since many of the beetles, when not actually feeding, sheltered in the long grass on the adjoining banks, this grass was first lightly sprayed with kerosene to discourage the feeding beetles from leaving the cress; the beds were then submerged by damming the water, which, on being quickly released, washed away very many of the beetles. These beds also received one application of the derris spray in August, and the combined

treatment gave effective control. An experiment with a derris dust proved too costly and was discontinued ; the use of arsenicals was considered inadvisable. Owing to the dense growth of the cress, the spray could only reach the adults when feeding on the tops of the plants, as was their habit in sunny weather, and earlier stages were probably unaffected.

LAIDLAW (W. B. R.). **The Enemies of the Elm Bark Beetle** (*Scolytus destructor*, **Oliv.**).—*Scot. For. J.*, xlvi, pt. 2, pp. 117–129, 6 figs., 10 refs. Edinburgh, October 1932. [Recd. June 1933.]

A brief account is given of the bionomics of *Scolytus scolytus*, F. (*destructor*, Ol.) and *S. multistriatus*, Marsh. [*cf. R.A.E.*, A, xvi, 586 ; xx, 121], which are serious pests of elm in southern England, with a list of their natural enemies taken from the literature. Those obtained by the author from *S. scolytus* were an unidentified mite, the predacious beetle, *Cryptophagus dentatus*, Hbst., the Eulophid, *Elachertus leucogramma*, Ratz., and the Cleonymid, *Cheiropachys colon*, L.

LAIDLAW (W. B. R.). **Two Ichneumon Parasites of** *Lophyrus pini* **Klug.**—*Ent. Mon. Mag.*, lxix, no. 829, pp. 124–132, 2 pls. London, June 1933.

Descriptions are given of both sexes of the Ichneumonids, *Lamachus pini* var. *caledonicus*, n., and *Holocremnus macellator* var. *cothurnatus*, Holmgr., together with a discussion of the systematic position of the latter. Both species emerged in the second week of August from cocoons of *Diprion* (*Lophyrus*) *pini*, L., taken from a plantation of Scots pine [*Pinus sylvestris*] in Scotland early in July. A list of other parasites of this sawfly is given from the literature.

AUSTIN (M. D.). **The Insect and Allied Fauna of cultivated Mushrooms, II.**—*Ent. Mon. Mag.*, lxix, no. 829, pp. 132–134. London, June 1933.

The following have been found in mushroom beds in Britain since a previous list was published [*R.A.E.*, A, xxi, 110] : the Mycetophilids, *Sciara fenestralis*, Zett., and *S. umbratica*, Zett. (*annulata* auct. nec Mg.), the larvae of which caused serious injury by tunnelling in the stems and caps of the mushrooms ; the Borborid, *Limosina ferruginata*, Stenh., which was taken in large numbers from a heap of composted manure and also from an established bed ; the Staphylinid, *Proteinus ovalis*, Steph., which was found in mushrooms attacked by other agencies and may be predacious ; the Proctotrupid, *Exallonyx ligatus*, Nees, which was present in small numbers in one sample attacked by the larvae of *Sciara* spp., on which it was possibly parasitic ; the mite, *Tyroglyphus mycophagus*, Megn., which was numerous and caused a certain amount of damage to the mushrooms ; the Diplopod, *Blaniulus guttulatus*, Bosc, which injured the stems and caps ; and the woodlouse, *Oniscus asellus*, L., which was frequently found in large numbers on the beds, where it injures the caps. Cecidomyiid and Lepidopterous larvae have also been observed infesting mushrooms. Comparatively few samples examined were free from mites, and it appears that several species occur in association with mushroom culture, some of which are doubtless beneficial, having been observed attacking *T. mycophagus* and feeding on the eggs of *S. agraria*, Felt.

Curwen [B. S.]. [Infestation of Telephone Exchange Wiring by *Tineola bisselliella*].—*Proc. S. Lond. Ent. Nat. Hist. Soc.*, 1931–32, pp. 47–48. London, 1932. [Recd. June 1933.]

The textile coverings of about half the wires on the main distribution frame, consisting of about 15,000 pairs, in a large telephone exchange in London have recently been extensively damaged by larvae of *Tineola bisselliella*, Humm., which ate through the two woollen layers round the rubber strips enclosing the wires, the maximum length completely stripped at any one point being about 3 ins. It was found that on reaching maturity the larvae attack material of other than animal origin from which to construct the cocoon, one formed of cotton yarn having been obtained.

Raucourt (M.) & Dupoux (R.). **Expérience de poudrage en grande culture dans le Limousin : dangers que présente l'entraînement par le vent des poudres arsenicales.**—*Rev. Path. vég. Ent. agric.*, xx, no. 4–5, pp. 160–170, 3 refs. Paris, 1933.

Experiments were carried out in France in July–August 1932 to determine whether arsenical dusts, when blown by wind, are liable to cause injury by drifting onto plants for which they were not intended, or whether they constitute a danger to man or animals. The technique employed in dusting potato fields with lead arsenate and calcium arsenate dusts, some of which contained copper salts, is described. The quantities of dust deposited were estimated by means of sheets of glycerined paper fixed on boards and placed at varying distances to leeward of the treated field, some in horizontal and some in vertical positions, raised slightly above the level of the ground. The papers were collected after dusting and the arsenic content determined. The velocity of the wind and the temperature and humidity of the air were determined during dusting. The highest residue found was 22 mg. As. to the square metre [about 0·28 grains to the sq. yd.], in immediate proximity to the treated field and under conditions of excessive wind. All the other tests gave a content of less than 8 mg. As. per sq. m. Potato foliage often receives 10–20 times this strength without suffering any trace of scorching. Horses and cattle are said to be capable of consuming 1·5–2·5 gm. of arsenic a day without showing any ill effects, and the lethal dose is estimated at 20 gm. [*R.A.E.*, A, xiii, 242]. Fowls have consumed 850 mg. of lead arsenate a day for 60 days without being affected in any way. As regards danger to man, the only articles of food likely to be eaten without washing are fruits. On the basis of the arsenic found on the vertical papers, the amount likely to be deposited on fruit is about 0·3 mg. As. per kg., whereas the tolerance in England for fruit imported from America after treatment with arsenicals is 1·082 mg. As. per kg. (0·01 grains As_2O_3 per lb.).

Feytaud (J.). **La question doryphorique au début de la campagne 1933.**—*Rev. Zool. agric.*, xxxii, no. 1, pp. 1–28, 3 maps. Bordeaux, January 1933. [Recd. June 1933.]

The distribution of *Leptinotarsa decemlineata*, Say, on potato in France at the beginning of the 1933 campaign is reviewed. Since 1931, the infestation has developed mainly on the lines indicated by, the new foci reported at the beginning of the 1932 campaign [*R.A.E.*

A, xx, 666]. The beetles were more widely distributed in the newly infested areas than was at first believed, a number of small foci developing between the points already marked and treated within the protective zones, particularly in the Loire Valley, beyond which the infestation has advanced considerably in the direction of Brittany, Normandy and Ile de France, but not much towards the east. The number of Departments more or less infested increased in 1932 from 30 to 37. The new limits of the protective zones are indicated.

Experimental dusting with lead arsenate has given partial control in the most severely infested areas, and the regular use of arsenical sprays, combined in some cases with soil treatment [xxi, 6], has made it possible to stamp out many of the small, outlying foci.

HARANT (H.) & SUSPLUGAS (J.). *Arima marginata* **coléoptère parasite accidentel du chrysanthème insecticide.**—*C. R. Acad. Agric. Fr.*, xix, no. 20, pp. 734–736, 1 ref. Paris, 14th June 1933.

In the spring of 1932 a number of fields of pyrethrum [*Chrysanthemum cinerariaefolium*] in Provence were completely destroyed by larvae and adults of *Arima marginata*, F. This Galerucid, which is briefly described, also occurs in Italy and causes injury to various cultivated plants, including lavender. The larvae were found in April on *Galium* spp. and *Rubia peregrina*. The adults appeared in large numbers in May on various composite plants, particularly *Centaurea pullata* and *C. aspera*, from which they invaded the neighbouring pyrethrum fields, attacking plants on which the flower buds had not yet opened.

In the laboratory, newly-emerged and mated adults fed on leaves of *C. pullata*, even if steeped in an alcoholic extract of pyrethrum, and on pyrethrum plants with the exception of the opened flowers, which they left untouched even when in need of food.

KOZLOVSKY (S.) & RUNGS (C.). **Note sur** *Depressaria cynarivora* **Meyr. Lépidoptère Oecophoridae, ravageur du** *Cynara scolymus* **(artichaut) au Maroc.**—*Bull. Soc. Sci. nat. Maroc*, xii, no. 4–6, pp. 101–103, 1 fig., 1 ref. Rabat [1933].

Larvae of *Depressaria cynarivora*, Meyr. [*R.A.E.*, A, xx, 660] were observed attacking artichoke (*Cynara scolymus*) in Morocco in 1932. The eggs were not found, but apparently hatch as soon as the young leaves appear at the end of September and the beginning of October with the first rains. The larva webs together the edges of a leaf intermediate between the central and older, outside ones, and feeds on the parenchyma. On the slightest touch it drops to the ground by a silken thread. The pupal stage is passed in the soil in a cocoon, to which particles of soil are attached, and lasts 19–27 days. Of 64 larvae reared, 59 matured, 14 being males, and 5 were attacked by parasites, *viz.*, *Eulophus* sp., the Ichneumonid, *Angitia chrysosticta*, Gmel., and the Tachinid, *Nemorilla maculosa*, Mg., which oviposits on the larva and develops in the cocoon.

It appears probable that this Tineid is present throughout the season from October to May. In artichoke beds infestation is always confined to the plants at the edges.

Zolotarevsky (B. N.). **Dans les foyers permanents. La lutte anti-acridienne.**—*Agron. colon.*, no. 185, pp. 145–148. Paris, May 1933.

As the result of the author's studies on *Locusta migratoria capito*, Sauss., in Madagascar [*R.A.E.*, A, xviii, 565], its control is now centred in its permanent breeding grounds. Following a visit to the Middle Niger region of French West Africa [*cf. R.A.E.*, A, xix, 709 ; xx, 97], he emphasises the need for a similar concentration of the control of *L. m. migratorioides*, Rch. & Frm., and *Schistocerca gregaria*, Forsk.

Ballard (E.), Mistikawi (A. M.) & El Zoheiry (M. S.). **The Desert Locust,** *Schistocerca gregaria* **Forsk., in Egypt.**—*Bull. Minist. Agric. Egypt*, no. 110, xi + 149 pp., 47 pls., 22 maps, 59 refs. Cairo, 1932. [Recd. June 1933.]

Major invasions by *Schistocerca gregaria*, Forsk., occur in Egypt every 12–13 years. A detailed account with maps is given of the series of invasions that began in 1928. Its analysis shows that they are due to autumn and spring migrations, the former consisting of locusts bred during the summer rains in the Sudan. These migrate northwards for some distance down the Nile valley, but do not as a rule stay in Egypt, as they turn off to the north-west towards Libya and Algeria, which are apparently invaded by swarms from the Sudanese summer breeding grounds. Other swarms bred in the Sudan fly across the Red Sea to Arabia and under favourable conditions they (or possibly their progeny bred in Arabia) reach Palestine, Transjordania and Egypt early in the spring. Soon after their arrival the locusts begin to breed, and the resulting adults fly southwards in May and June, mainly through Arabia, but sometimes passing through Egypt.

The invasions of Egypt depend principally on the direction of winds prevailing at the periods of migrations, and the danger is greatest in winter and spring when the predominating north-easterly to easterly winds bring with them locusts from Arabia.

A very detailed account is given of the results of observations, under field and laboratory conditions, on the biology of *S. gregaria*. Of the data obtained, the following are of particular interest. The length of adult life is shortest in winter and longest in summer. The time required for sexual maturation is not uniform, varying from 13 to 113 days, with an average in winter of 46 days for males and 59 for females. It varies inversely with the length of nymphal life. One female can lay from 1 to 6 egg-pods, the number of eggs in a pod varying from 28 to 124. The incubation period averages 32 days in spring and 26 days in summer and autumn ; in winter a diapause in the egg stage may occur, the period extending to 87 days. Under laboratory conditions the average percentage of hatching is 83·5, but excessive moisture or dryness causes great mortality. The hoppers undergo five, rarely six, moults, and in winter the duration of the nymphal stage may be greatly extended. There may be up to three generations a year ; in the laboratory five were produced in two years. The complete life-cycle requires 107, 138 and 131 days in the spring, summer and autumn generations respectively.

The destruction of the eggs by ploughing, harrowing or flooding the infested areas and of the hoppers by crushing are not recommended. In the 1930 invasion in Egypt, flame-throwers, trenches and barriers, and poison baits of wheat bran and sodium arsenite were used. Baits

were very effective, not only against hoppers, but also against sexually immature adults, especially when newly emerged. Flame-throwers were very useful for destroying both adults and hoppers, but the costs of maintenance and operation were high. The success of the campaign was largely the result of careful scouting and marking of egg-areas and an accurate intelligence service dealing with the movements of the locusts.

UVAROV (B. P.). **The Locust Outbreak in Africa and Western Asia, 1925–31.**—*Econ. Adv. Coun., Comm. Locust Contr.*, 87 pp., 13 maps. London, H.M.S.O., 63–80, 1933. Price 5*s*.

The present outbreaks of *Schistocerca gregaria*, Forsk., in Africa and western Asia and of *Locusta migratoria migratorioides*, Rch. & Frm., and *Nomadacris septemfasciata*, Serv., in Africa, are discussed from their known beginnings, the developments being followed from season to season for each region separately and illustrated by a series of maps. The information summarised in this way forms the basis for a discussion of the breeding areas and seasons and migration routes of each species, and the factors regulating them.

As the main result of the survey, a clear general idea has been obtained of the breeding areas and migrations of the three species, each of which has definite requirements. The breeding and migrations are regulated primarily by climatic conditions, and the original breeding centres are few in number and probably limited in extent, but the swarms arising from them spread over enormous distances. The problem, therefore, is an international one and can only be solved by the discovery of the original breeding areas, which could then be kept under constant observation for the suppression of incipient outbreaks.

It is pointed out that since under subtropical and tropical conditions the egg and the hopper stages are of short duration, and the adult stage usually lasts much longer, the present methods of control directed mainly against hoppers must give way to those directed against the adults. Amongst them, the dusting of flying swarms from aeroplanes [*cf. R.A.E.*, A, xx, 337] is advocated.

Appendices contain suggestions for bioclimatic observations and a list of books and papers on the locust and grasshopper problem published in 1926–1931.

[NEFEDOV (N. I.).] **Нефедов (Н. И.). Zur Heuschreckenfauna des Kustanaj Distrikt (N.-W. Kasakstan) und ihre Verteilung nach Biotopen.** [The Acridids of the First Kustanaĭ Soviet Grain Farm and Moskalevo Soviet Farm and their Distribution in the various Habitats. (*In Russian.*)]—*Bull. Inst. Rech. biol. Perm*, viii, no. 4–5, pp. 151–188, 1 map, 17 diagr., 31 refs. Perm, 1933. (With a Summary in German.)

In this and the two following papers, the author records the results of investigations in 1931 on the ecological distribution of Acridids in three localities of the Kustanaĭ district of north-western Kazakstan. Samples of the grasshopper population were taken by making 200 sweeps of a net in each habitat, 955 plots being studied in this way. It was found that the difference between the population of each type of habitat is mostly quantitative, the same species occuring in different percentages, and that the density of vegetation exercises a considerable influence on the distribution of the species. Overpastured lands

harbour most of the injurious species, such as *Arcyptera microptera*, F.W., *Dociostaurus crucigerus brevicollis*, Ev., *Aeropus* (*Gomphocerus*) *sibiricus*, L., and *Calliptamus italicus*, L. Detailed lists of the grasshopper population of each habitat are given, and the ecological characteristics of the more important species are discussed.

[NEFEDOV (N. I.).] **Нефедов (Н. И.). Ueber die Phänologie der wichtigsten Heuschreckenarten in den Umgebungen von Kustanaj (N.-W. Kasakstan).** [Notes on the Phenology of Acridids. (*In Russian.*)]—*Bull. Inst. Rech. biol. Perm*, viii, no. 4–5, pp. 189–204, 8 diagr., 9 refs. Perm, 1933. (With a Summary in German.)

Most of the Acridids occurring in the Kustanaĭ district hatch in May and are in the hopper stage throughout June, but *Arcyptera microptera*, F.W., becomes adult in the second half of the latter month. The middle of June is therefore considered the best time for beginning a campaign against the hoppers.

[NEFEDOV (N. I.).] **Нефедов (Н. И.). Ueber die Oekologie der Eikapseln der Heuschrecken (Locustodea) und die Methode zur Abundanzbestimmung derselben.** [Contribution to the Ecology of the Egg-pods of Acridids and the Methods of Field Investigations in tracing Areas infested with them. (*In Russian.*)]—*Bull. Inst. Rech. biol. Perm*, viii, no. 4–5, pp. 205–222, 5 diagr., 11 refs. Perm, 1933. (With a Summary in German.)

The egg-pods of *Arcyptera microptera*, F.W., and *Dociostaurus crucigerus brevicollis*, Ev., are most commonly met with in habitats with alkaline soil and sparse vegetation [*cf. R.A.E.*, A, xxi, 31], and those of *Aeropus* (*Gomphocerus*) *sibiricus*, L., are most numerous in pastures with *Artemisia austriaca*. Fallow fields were little infested with grasshopper eggs, and the cultivation of the steppes produces conditions unfavourable to *Arcyptera* and *Dociostaurus*.

HARUKAWA (C.), TAKATO (R.) & KUMASHIRO (S.). **Studies on the Seed-corn Maggot. II.**—*Ber. Ōhara Inst. landw. Forsch.*, v, no. 3, pp. 457–478, 5 figs., 3 refs. Kuraschiki, 1933.

An account is given of further observations on the biology of *Phorbia* (*Hylemyia*) *cilicrura*, Rond. [*cf. R.A.E.*, A, xviii, 675] on soy beans in Japan, carried out chiefly during 1930–31. The preoviposition period is stated to be shorter than previously supposed. The following is largely taken from the authors' summary : The adults were found to be present throughout the year, the greatest number being caught (in glass traps baited with dried pupae of the silkworm [*Bombyx mori*, L.]) in March–May and the lowest in July–September and December–January. Examination of experimental plots of newly sown soy beans showed that larvae and pupae were most abundant in April–May and again in October ; none was found in July–August or in January. A corresponding increase and decrease was noted in the percentage of injured plants. Laboratory experiments carried out in 1928–31 on the length of the various stages and their relation to the mean temperature showed that the eggs and larvae develop throughout the year, the egg stage varying from 2 to 17·6 days and the larval stage from 7·2 to 37, but the pupae undergo a temporary cessation of development in winter, the pupal period

ranging from 9·2 to 107 days. The life-cycle from egg to adult varies from 85 days at an average of 9·7°C. [49·5°F.] for eggs laid in February to 18–19 at 25°C. [77°F.] for those laid in July; for those laid at the end of November or the beginning of December it is about 130 days, varying markedly in different individuals. The larvae were not usually found in dry fields in summer, but small numbers of females appeared to live and produce summer broods where soil moisture and other conditions were favourable. No support was obtained for the view [xx, 350] that the summer is passed in the pupal stage. The flies may overwinter at any stage of development; the adults shelter in crevices in the soil or other protected places and, though they are scarce, may be found seeking food on calm, warm days.

NISIKADO (Y.) & YAMAUTI (K.). **Contributions to the Knowledge of the Sap Stains of Wood in Japan. I. Studies on *Ceratostomella ips* Rumbold, the Cause of a Blue Stain of Pine Trees in Western Japan.** —*Ber. Ōhara Inst. landw. Forsch.*, v, no. 4, pp. 501–538, 1 fig., 12 pls., 15 refs. Kuraschiki, 1933.

A detailed account is given of investigations on *Ceratostomella ips* [*cf. R.A.E.*, A, xx, 172], which was found over a limited area in Japan in the sap-wood of *Pinus densiflora* and *P. thunbergii*, chiefly in association with infestation by bark-beetles, apparently of the genus *Ips*. Attack by this fungus resulted not only in discoloration of the wood but also in the death of the trees.

YUASA (H.). **On the Structure of some Japanese Buprestid Larvae, with Notes on their Life-history.** [*In Japanese.*]—*J. Imp. Agric. Expt. Sta. Nishigahara*, ii, no. 2, pp. 263–282, 4 pls., 23 refs. Tokyo, March 1933. (With a Summary in English.)

Among the larvae dealt with are those of *Agrilus auriventris*, Saund., which infest the inner bark and outer wood of *Citrus* in Japan [*cf. R.A.E.*, xvii, 195], and *A. mali*, Mats., which attack apple in Korea [*cf.* xii, 388].

CLAUSEN (C. P.). **The Citrus Insects of tropical Asia.**—*Circ. U.S. Dept. Agric.*, no. 266, 35 pp., 25 refs. Washington, D.C., May 1933.

The following is substantially the author's summary: Approximately 200 species of insects are listed as attacking *Citrus* in tropical Asia. The great majority are scale-insects, though these do not occupy the dominant position that they hold in the United States. The insects attacking the fruit itself include a series of fruit-flies, two Lepidopterous borers, and a number of Noctuids, the adults of which suck the juice of the ripening fruits. The fruit-flies are of minor importance in the Tropics, and the only species recorded as assuming a destructive status is *Dacus* (*Chaetodacus*) *dorsalis*, Hend., under the subtropical conditions of Formosa. The larger Lepidopterous fruit borer, *Citripestis sagittiferella*, Moore, is exceedingly destructive but is only known in Malaya and the Netherlands Indies. The most important of the foliage feeders is the Curculionid, *Hypomeces squamosus*, F., which is of general occurrence throughout the Tropics. Others may

be equally injurious in more limited areas. Three species of leaf-miners are known, of which two are important and only one, *Phyllocnistis citrella*, Stn., of general distribution throughout all the *Citrus*-producing countries of Asia.

Among the scale-insects no one species is present in uniform and destructive status over a large area. The more injurious species are *Lepidosaphes beckii*, Newm., *Prontaspis* (*Chionaspis*) *citri*, Comst., *Parlatoria zizyphus*, Lucas, *Chrysomphalus aurantii*, Mask., *Pulvinaria polygonata*, Ckll., and *Coccus viridis*, Green. *Chrysomphalus aurantii* and *Parlatoria zizyphus* are heavily attacked by fungus, though not controlled, whereas *Pulvinaria polygonata* and *Coccus viridis* are at times completely wiped out through this agency. Among the Aleurodids, *Aleurocanthus spiniferus*, Quaint., is at times destructive in the Philippines, Sumatra, China and India, and is one of the major pests in southern Japan. *A. citriperdus*, Quaint. & Bak., occasionally becomes very abundant in Malaya and the Netherlands Indies, but is periodically controlled by fungus attack. *A. woglumi*, Ashby, is a very minor pest in all countries of tropical Asia.

Of the bark, twig, and trunk borers, the Buprestid, *Agrilus occipitalis*, Eschsch., is ranked as a major pest in the Philippines, and some one of this family is found in every tropical country. *Melanauster chinensis*, Forst., the injurious Lamiid trunk borer of China, Formosa, and Japan, does not extend into the strictly tropical regions. In the case of a number of the remaining Longicorns listed, there is some doubt as to whether they attack living trees or breed more largely in dead branches and in trees that have been weakened by other agencies.

ANDRIÉS (H. E.). Ed. **Controlling Plant Pests in southern Africa. A Handbook for the Fruitgrower, Orchardist, Gardener and Grower of Field Crops.**—Med. 8vo, viii+199+xvi pp., 160 figs. Johannesburg, Cooper & Nephews, S. Af. (Pty) Ltd., 1932. Price 3*s*. 6*d*. [Recd. July 1933.]

This book, which deals with the bionomics and control of the chief pests and diseases of *Citrus*, deciduous fruit trees, vines and field crops in South Africa, constitutes a useful compendium of practical information compiled from personal observations and from the literature. The importance of spraying and the principles underlying pest control are briefly indicated. Descriptions are given of the principal insecticides, fungicides and other horticultural remedies recommended, together with directions for obtaining correct dilutions and tables of weights and measures. The equipment and procedure by which they may be best applied are also dealt with. Brief instructions for the planting of *Citrus* and deciduous trees are included. An index is appended.

KING (C. B. R.). **Report of the Entomologist for the Year 1932.**—*Bull. Tea Res. Inst. Ceylon*, no. 10, pp. 27–33. Kandy [1933].

Trichogramma evanescens, Westw., a consignment of which was received from the Imperial Institute of Entomology in January, was no easier to rear in the eggs of *Sitotroga* [*cerealella*, Ol.] than *T. erosicornis*, Westw., the local parasite of *Homona coffearia*, Nietn. [*cf. R.A.E.*, A, xvii, 414]. Throughout most of the year it was bred in eggs of *Corcyra cephalonica*, Stn., though reproduction was more prolific in those of *Ephestia kühniella*, Zell. Early in the year only about 3–4 per cent. of the grain moth eggs hatched, and it was thought that

the food value of the meal might be affected by the heat treatment used to kill all competing organisms, chiefly *Tribolium* spp. and mites. The addition of a little Marmite and cod liver oil before placing the eggs in the meal resulted in a marked improvement in the rate of survival and also in the fecundity of the females. *Trichogramma evanescens* has also been found to attack the large eggs of *Attacus ricini*, Boisd., though the rate of parasitism is not high. *Gracilaria theivora*, Wlsm. (tea-leaf roller) was fairly common in one locality in September, though it did not cause much economic damage. The usual species of nettle grubs (Limacodids) were reported from tea during the year [*cf.* xx, 496], and lists are given of new records of food-plants and parasites, the latter, with the exception of the Eulophid, *Trichospilus pupivora*, Ferrière, on *Thosea cervina*, Moore, having already been noticed [xx, 497]. A few individuals of *Miresa argentifera*, Wlk., *Scopelodes venosa*, Wlk., and a third species of nettle grub, hitherto unknown, were also taken on tea. A consignment of the Tachinid, *Chaetexorista javana*, Br. & Berg., was received from America through the Imperial Institute of Entomology at the end of May, and liberations were made in fields in which *T. cervina* was prevalent. Numerous contact sprays and two stomach poisons were found to be less effective against nettle grubs than soap and water [xx, 498], which when properly applied should give a mortality of about 80 per cent. Predacious enemies of the larvae included the Pentatomid, *Cantheconidea* (*Canthecona*) *robusta*, Dist., various birds and, in the insectary, ants and a lizard (*Calotes versicolor*), but wilt disease appeared to kill larger numbers than all the other natural enemies combined.

Other parasites of tea pests identified during the year were the Ichneumonids, *Phytodietus capuae*, Morl., and *Stictopisthus* sp., the Braconids, *Microdus* sp. and *Apanteles* sp., the Chalcid, *Brachymeria euploeae*, Westw., *Elasmus homonae*, Ferrière, and the Eulophid, *Tetrastichus* sp., from *H. coffearia*, the Ichneumonid, *Angitia* (*Dioctes*) sp., and the Eulophid, *Asympiesiella india*, Gir., from *G. theivora*, and *B. euploeae* and the Eupelmid, *Anastatoidea brachartonae*, Gahan, from *Psyche vitrea*, Hmpsn. Lists are given of other pests reported from tea, including the Geometrid, *Boarmia bhurmitra*, Wlk., and also from green manure and shade trees, together with a table showing the distribution of nettle grubs and the severity of their attacks.

Hutson (J. C.). **Pests of Garden Plants. 1. The Root-eating Ant** (*Dorylus orientalis*, **Westw.). 2. Cockchafer Beetles.**—*Trop. Agriculturist*, lxxx, no. 5, pp. 276–284, 6 refs. Peradeniya, May 1933.

Dorylus orientalis, Westw., which has been recorded for several years damaging potato tubers in India, has recently been found attacking the underground parts of a variety of vegetables and young trees, such as *Citrus*, in Ceylon. The workers live entirely underground, injuring the plants chiefly from May to September.

In areas infested by this ant, soil should be thoroughly treated with petrol before planting, the fumigant (at the rate of 1–2 pints to 30 sq. ft.) being placed in shallow furrows or small holes along the plant beds, or sprinkled beneath the top few inches of surface soil As a repellent, sawdust or wood ashes soaked with a carbolic disinfectant diluted in water may be worked thoroughly into the top layer of the soil a day or two before planting. When a plant shows signs of wilting from infestation, it should be removed carefully, and before the ants disperse a

little petrol should be poured into the hole, which should then be filled in with damp earth. Petrol may also be placed in a circular furrow at a radius of 6–9 inches round individual plants. Sawdust or wood ashes impregnated with carbolic and placed round the plants one to two days after petrol treatment act as a deterrent.

Very brief descriptions are given of the adults of the more important Melolonthids and Rutelids occurring in Ceylon, with notes on their feeding habits and, if known, those of the larvae, and a general account of their bionomics and control.

SMITH (J. H.). **Caterpillar Plagues in Grasslands and Cultivation Paddocks.**—*Queensland Agric. J.*, xxxix, pt. 4, pp. 155–160, 1 pl. Brisbane, 1st April 1933.

An account is given of data accumulated during severe outbreaks of *Spodoptera mauritia*, Boisd., and *Laphygma* (*S.*) *exempta*, Wlk., that occurred at about the same time during the summer of 1931–32 at several widely separated localities in Queensland. In the majority of the pastures, only *Paspalum dilatatum*, the most widely distributed fodder grass, was attacked. Since various other plants that were untouched in the field were eaten in the laboratory, this preference is probably due to adaptation of the larvae in the field to the type of food available during early life. Maize was also infested ; the young and succulent plants were eaten to the ground, and in the older ones the development of the cob was affected by the loss in leaf surface. Pastures are usually attacked by cutworms in spring or summer when growing conditions are good, and removal of the stock will enable the grass to outgrow the injury so as to be available for use later in the season. On maize, if an outbreak occurs in December or early January, replanting after it has subsided may yield a satisfactory crop, but one sown later would be more suitable for fodder than as a source of grain. Areas may be protected from invasions of migrating larvae by ploughing a deep furrow in front of their line of advance and placing in it liberal amounts of Paris green baits.

In one area of infested pasture under observation the soil was denuded of grass and almost free from accumulated humus, so that the surface was exposed to high midday temperatures and suitable sites for pupation were not readily available. Pupae were only found in numbers clustered together in moist cow dung, as many as 50 being recovered from one mass. All the outbreaks subsided after one generation, probably owing to the combined attack of entomogenous fungi and insect parasites, including a Tachinid, which destroyed almost 50 per cent. of pupae taken in the field, and also to overcrowding of the cutworms. Climatological data recorded during the outbreak showed two periods of unusually high temperature separated by a few days of heavy precipitation. Notes are given on the life-cycle of *S. mauritia* as observed in the laboratory in February and March, when it occupied slightly less than 3 weeks.

DAVIDSON (J.). **On the Control of the "Lucerne Flea"** (*Sminthurus viridis* **L.**) **in Lucerne in South Australia.**—*J. Dept. Agric. S. Aust.*, xxxvi, no. 9, pp. 994–1006, 8 figs., 2 refs. Adelaide, 15th April 1933.

One of the chief difficulties in the establishment of a stand of clover or lucerne in South Australia is its protection from infestation by

Smynthurus viridis, L., which is polyphagous and occurs throughout the areas of more abundant rainfall [*cf. R.A.E.*, A, xx, 543]. The damage, which consists of a speckling of the leaves by the young nymphs and destruction of the green tissues by the older insects, is caused during the wet season, which usually occurs from April–May to September–October. Three or more generations may occur during this period. From June to August the springtails are less numerous and less active in many localities owing to the cold, wet conditions at the soil surface. From experiments on plots, in which the fluctuations in degree of infestation were recorded, it is concluded that the numbers of the first generation may be reduced before oviposition occurs by cutting the crop or using it for grazing 3–4 weeks after the aestivating eggs begin to hatch in autumn, and then applying a spray of 1 gal. lime-sulphur in 60 gals. water at the rate of 80–100 gals. per acre and at a pressure of about 200 lb. The number of subsequent applications depends on the severity of the infestation, but spraying should always be immediately preceded by mowing. During certain months, when lucerne grows slowly in most districts, heavy damage may be caused by a relatively light infestation. After vigorous growth commences in early spring (about August), control measures should be applied again. If the crop is mown about the end of September, preferably during dry, warm weather, the growth of annual weeds will be checked and the soil surface exposed, resulting in the death of many of the springtails and in a reduction in the number of eggs. A strip of clear fallow left round the field will protect it from invasion, provided that the neighbouring attack is not heavy.

During the dry season the springtails aestivate in the egg stage [*cf.* xx, 400, 556 ; xxi, 348, etc.]. In irrigated areas the surface of the soil normally dries within a few days, but some of the eggs may hatch during cool periods. Where suitable moisture conditions are maintained for about 3 weeks by frequent irrigations, they may all develop, but the high temperatures may kill the embryos and adversely affect any springtails that hatch. These may be readily killed by cutting the crop so as to expose them to dry conditions. With an open soil, however, many may penetrate into crevices where the moisture is favourable. In experimentally irrigated plots, infestation was first noticed early in February and, the crop having been cut on 16th February, the insects died during the next few days. Plots receiving no irrigation were first infested after the autumn rains in April and severe damage had been caused by the end of May, at which time the treated plots contained comparatively few springtails and were making vigorous growth. On irrigated swamp soils, however, the frequent applications of water required may be impracticable, owing to the danger of waterlogging and killing the lucerne plants.

WOMERSLEY (H.). **A possible Biological Control of the Clover Springtail or Lucerne Flea** (*Sminthurus viridis* **L.**) **in Western Australia.**—*J. Coun. Sci. Industr. Res. Aust.*, vi, no. 2, pp. 83–91, 1 pl. Melbourne, May 1933.

Investigations were carried out in Western Australia during 1930–32 to discover some natural agency for the control of *Smynthurus viridis*, L., which is very difficult to control by cultural measures or insecticides owing to the extent of the areas it infests and the enormous numbers in which it occurs, particularly on subterranean clover [*Trifolium*

subterraneum]. It has apparently been present since 1884 and is only found where the annual rainfall exceeds 16 ins.; it is rare in sandy country owing to the habit of the nymphs and adults of ingesting soil. Literature relating to its predators is discussed, parasites being unknown. The Bdellid mite, *Biscirus lapidarius*, Kramer, all stages of which are described, was found in several localities in which *S. viridis* was either decreasing in numbers or was absent, and subsequent examination showed that it was exterminating the latter and migrating to adjoining affected fields, having thus freed from infestation an area of approximately 65 acres in one locality. In another situation it was found concentrated in large numbers at the base of a stack of clover and was apparently transported with this clover to a spot about ½ mile away, since a diminution in the surrounding infestations was subsequently observed.

It may be possible to transport the mites for considerable distances by means of scrapings from the base of stacks, but local dissemination is best accomplished on pieces of fallen, curled bark, under which they usually shelter in large numbers in the field. Various attempts to introduce them into other localities were made in 1931 and 1932, but in some cases no results are yet apparent. In 1931 about 12 individuals were liberated in a field heavily infested with *Katianna ornata*, Womersley; by the beginning of the following season this Smynthurid was scarce, and later the mites were found to have migrated to surrounding areas.

The eggs are laid on the decayed plant fibres lying on the ground or on the ground itself and probably aestivate. The larval period is probably short, as larvae are seldom found in the field. At certain times, mites of all sizes collect beneath pieces of bark, etc., or under the webs of spiders or Psocids and undergo a period of dormancy, which may last for several days. These resting individuals are rather lighter in colour than the active ones. The adults feed voraciously on various Collembola and have also been observed to attack Psocids and other small insects. Decided preference is shown for *S. viridis*, particularly the nymphs, 18 of which were consumed in 24 hours on 3 successive days by a single individual in preliminary experiments. It is considered that larger numbers might have been destroyed had they been available. Where the population of *S. viridis* is large or is increasing, only Bdellids other than *B. lapidarius* are present. In his conclusions the author points out that this is the first time any mite has been used for purposes of biological control.

Evans (J. W.). **Some Preliminary Tests on the Control of** ***Thrips imaginis*** **Bagnall.**—*J. Coun. Sci. Industr. Res. Aust.*, vi, no. 2, pp. 99–102, 3 refs. Melbourne, May 1933.

Experiments were carried out in South Australia in the spring of 1932 on the control of thrips, chiefly on apple and plum blossoms, the commonest species being *Thrips imaginis*, Bagn., though *Isoneurothrips australis*, Bagn., *T. tabaci*, Lind., and *Haplothrips victoriensis*, Bagn., were taken in small numbers in almost every sample of blossom. Almost complete control was obtained over a period of 48 hours with a pyrethrum dust, even when mixed with sulphur at the rate of 1 : 10. Sulphur alone was practically ineffective. It was not possible to determine the lasting qualities of the dust on apple blossoms during hot weather, but it remained effective on roses for three days at a high temperature. Nicotine dusts killed the thrips more quickly than

pyrethrum but did not have a lasting effect as repellents, and sprays of lime-water or lime-sulphur and resin [*R.A.E.*, A, xx, 601] also showed no effective deterrent qualities.

The Greenhouse White-fly in Tasmania.—*J. Coun. Sci. Industr. Res. Aust.*, vi, no. 2, pp. 127–128. Melbourne, May 1933.

An unsuccessful attempt was made to introduce *Encarsia formosa*, Gahan, from England into Tasmania for the control of *Trialeurodes vaporariorum*, Westw., which causes serious damage in hot-houses, particularly to early tomatos. Only 3 or 4 individuals emerged from the consignment over a period of a month, and these died shortly afterwards. Further efforts to introduce this Aphelinid will be made in the spring or summer. All attempts hitherto made to establish it in countries south of the Equator have failed, its vitality being greatly affected by transport in cool storage.

WARD (F. E.). [**Notes on Insect Pests.**]—*Ann. Rep. Dept. Agric. Tasmania*, 1930–31, p. 41 ; 1931–32, pp. 41–44. Hobart, 1931–32. [Recd. June 1933.]

Experiments in 1930–31 on the control of *Smynthurus viridis*, L. (clover springtail), the incidence of which in Tasmania appears to be well defined and limited to a few areas, showed lime-sulphur (1 : 60) to be the cheapest and most effective material [*cf. R.A.E.*, A, xviii, 589]. Liberations of *Aphelinus mali*, Hald., against the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] were continued in January 1931 and in January and February 1932. Owing to the dry and warm spring and early summer, small outbreaks of *Nysius vinitor*, Bergr. (Rutherglen bug) occurred in several localities in 1931–32, but it disappeared with the occurrence of cooler and moister conditions. The Jassid, *Typhlocyba australis*, Frogg., which has not previously been recorded in Tasmania, and *Thrips imaginis*, Bagn. [*cf.* xx, 601] both occurred on apple trees, though no noticeable injury was caused. The larvae of the light brown apple moth [*Tortrix postvittana*, Wlk.] caused serious damage in some localities. Owing to their habit of sheltering in rolled leaves low down on the trees, the presence of fowls in the orchards during the winter and early spring should be advantageous. *Eriophyes tristriatus*, Nal., appears to have spread considerably on walnut since it was first observed about 4 years ago. It disfigures the leaves and an increase in its numbers would probably lead to defoliation of the trees. *Penthaleus bicolor*, Frogg. (red-legged pea mite) occurred in several localities but does not seem to be spreading and is readily controlled by lime-sulphur (1 : 100). The potato moth [*Phthorimaea operculella*, Zell.] was common on tobacco wherever it was grown and considerable damage was also caused by *Phytometra* (*Plusia*) *argentifera*, Gn., in some places. Bulbs were infested by *Merodon equestris*, F. Larvae of *Dacus* (*Bactrocera*) *cucurbitae*, Coq., were found in imported cucumbers. *Anthrenus scrophulariae*, L., has become very common in Hobart, damaging furs, woollen goods, etc.

CUNNINGHAM (G. H.) & COTTIER (W.). **Orchard Sprays in New Zealand. IV. The Arsenate Series.**—*N. Z. J. Agric.*, xlvi, no. 4, pp. 211–221, 15 refs. Wellington [N.Z.], 20th April 1933.

The properties of lead and calcium arsenates are discussed, and the units of value used for defining their characteristics are indicated in

order to facilitate the interpretation of data placed on the container by the manufacturer. Notes are also given on the more important factors affecting their toxicity to plants and insects and on their use as orchard sprays in New Zealand.

Box (H. E.). **Observations on Sugar-cane Moth Borers** (*Diatraea* **spp.) in St. Lucia. Report upon a short Visit to St. Lucia, March, 1933.**—Fol. 5 pp., 5 refs. Castries [St. Lucia, B.W.I.], 1933.

An account is given of a survey undertaken from 25th to 29th March to determine the importance of *Diatraea* spp. on sugar-cane in St. Lucia. The cultivation of the crop and previous work on moth borers attacking it there are briefly discussed. The species concerned are *D. saccharalis*, F., and *D. canella*, Hmpsn., one or both of which occur in varying degrees of intensity in every cane-field throughout the Island. The characteristic dead-heart injury, caused by the killing of the young shoots, was observed in all fields of young plant cane or ratoons. A total of 16 examinations, involving counts of healthy and damaged joints of 540 canes, revealed 67·6 and 16·2 per cent. average infestation of the stalks and joints respectively. The average number of joints bored per infested cane was 7·3 in one area, indicating a loss of about 20 per cent. of the crop. *D. saccharalis* was abundant on maize in one field. A list is given of other grasses on which one or both species were found to feed in St. Lucia, 3 of which are recorded for the first time, and also of grasses known to serve as food-plants elsewhere.

Evidence of parasitism of the eggs by *Trichogramma minutum*, Riley, and *Telenomus* (*Prophanurus*) *alecto*, Cwfd., and of the larvae by *Microdus stigmaterus*, Cress., was observed. It appeared that parasitism of the larvae is greater in wild grasses than in sugar-cane ; in one instance cocoons of *M. stigmaterus* were found in about 50 per cent. of the stalks of *Paspalum virgatum* infested chiefly by *D. canella*.

Control by biological methods is recommended. In the dry, windward districts, conditions would probably be suitable for the establishment of *Lixophaga diatraeae*, Towns., recently imported into Antigua [xxi, 162].

Chapin (E. A.). **A new Genus of West Indian Coccinellidae.**—*Proc. Biol. Soc. Wash.*, xlvi, no. 19, pp. 95–100, 1 pl.

Boving (A. G.). **Description of the Larva of** *Decadiomus pictus*, **Chapin (Scymnini, Coccinellidae).**—*T.c.*, no. 20, pp. 101–104, 1 pl., 1 ref. Washington, D.C., 27th April 1933.

In the first paper, *Decadiomus*, gen. n., is erected for *Scymnus* (*Diomus*) *bahamicus*, Casey (the type) and four new species, *viz.*, *D. pictus* and *D. tricuspis* from Porto Rico, *D. hubbardi* from Montserrat, and *D. peltatus* from Cuba. *D. tricuspis* was collected on *Carica papaya* attacking *Aleurodicus* (*Metaleurodicus*) sp., and *D. pictus* was reared from larvae feeding on *Icerya purchasi*, Mask.

Watson (J. R.) & others. **Entomology.** *Ann. Rep. Florida Agric. Expt. Sta. 1931–32*, pp. 69–91. Gainsville, Fla. [1933.]

Many of the pests observed in Florida during 1931–32, were recorded in the previous report [*R.A.E.*, A, xx, 647]. The gladiolus thrips

[*Taeniothrips gladioli*, Moult. & Stnw.] was found for the first time in the State, in plantations of gladiolus in which corms imported from the north were grown. In work on pests of *Citrus*, 12,000 individuals of *Cryptolaemus montrouzieri*, Muls., were liberated in 90 groves against mealybugs, but in the localities under observation a fungus disease appeared in July and killed the mealybugs before the beetles had increased sufficiently to control them. *Leis conformis*, Boisd., introduced for the control of *Aphis spiraecola*, Patch, in 1925–26 [xv, 585], was recovered in two groves, and in the one where the Coccinellid was very abundant the Aphid infestation was lower than the average. Trees sprayed three times at intervals of 4 weeks with lime-sulphur (1 : 40) against *Lepidosaphes beckii*, Newm., showed 4–19 per cent. fewer living scales than the control trees. In experiments against *Schistocerca americana*, Drury, which was common in *Citrus* groves, baits of 50 lb. bran containing 10–15 grapefruits, 1 U.S. gal. syrup and 2 lb. sodium fluoride or 3 lb. of a 98 per cent. fluosilicate gave 100 per cent. mortality in the laboratory, and the fluosilicate gave 84 per cent. control in the field. In further laboratory tests, copper carbonate in a bran mash only gave good results when used in large quantities ; a dust containing 18 per cent. sodium fluosilicate gave 100 per cent. control in 6 days when both plants and grasshoppers were dusted, but did not adhere well to the leaves. The same dust used with a small quantity of a sulphonated oil derivative as an adhesive against *Macrodactylus angustatus*, P. de B., which was attacking orange buds [xx, 355], gave 100 per cent. control when applied to both flowers and beetles in the insectary, and the oil seemed to act as a repellent. *Calotermes* (*Neotermes*) *castaneus*, Burm., was reported damaging grapefruit, orange, lime and tangerine trees in one district, branches 8 feet from the ground and roots 9 feet long being hollowed out, and *Aphis spiraecola* caused considerable damage to all these trees except limes, attacking the young buds so that neither leaves nor fruit matured.

Bean crops were severely injured in 1931 and 1932 by *Empoasca fabae*, Harr. One of the four varieties of bean planted was apparently less susceptible than the others. Pyrethrum sprays proved the most effective of the insecticides tested against this Jassid, and almost as good control was obtained with 40 per cent. nicotine sulphate with one of the newer spreaders, such as a sulphonated oil product or a sodium oleate soap. Dusting with flowers of sulphur gave only slight control. Migration from surrounding vegetation took place so rapidly that after six days all treated plots were reinfested. A method of confining Jassids on the plants for counting is described. The Delphacid, *Peregrinus maidis*, Ashm., which migrated from the surrounding grass, was nearly as numerous on beans as *E. fabae* but less injurious. Pests of pecan included the Aphid, *Longistigma caryae*, Harr., which prevented the setting of the nuts, and a mite (? *Tetranychus* sp.), which defoliated several trees in one district. *Coleophora caryaefoliella*, Clem. (cigar case-bearer) is an important pest in western Florida, but the larvae, owing to their method of feeding, could not be controlled by stomach poisons, and contact sprays did not readily penetrate their cases. *Oncideres cingulatus*, Say, which girdles the twigs, was prevalent in one district, and *Eucolaspis* (*Colaspis*) *brunnea*, F., caused some damage to the young foliage.

Reference is made to the beginning of observations on parasites of *Laphygma exigua*, Hb. [*cf.* xxi, 80, 290].

DOUGLASS (J. R.). **Hibernation of the Mexican Bean Beetle in the Estancia Valley, N. Mex.**—*J. Agric. Res.*, xlvi, no. 7, pp. 579–605, 15 figs. Washington, D.C., 1st April 1933.

A detailed account is given of investigations on the hibernation of *Epilachna corrupta*, Muls. (Mexican bean beetle) in three vegetation zones in the Estancia Valley, New Mexico, from 1923 to 1929.

In the "Canadian zone," where the predominant conifers are *Pseudotsuga mucronata* and *Picea engelmanni*, 38,500 beetles were released in forest cages during five years; in four of the years none survived, but of those released in 1926–27, when the winter was abnormally mild and the precipitation about normal, 0·56 per cent. survived. In the "transition zone," where *Pinus ponderosa* predominates, 133,340 beetles were released in six years with a total survival of 9·84 per cent. In the "upper Sonoran zone," characterised by *Juniperus monosperma* and *Pinus edulis*, of 44,500 beetles 2·72 per cent. survived. There was a constant relation between type of vegetation and survival. Natural hibernation evidently occurs chiefly in the "transition zone" which is especially favourable when oak (*Quercus gambelii*) is associated with the pines, a mixture of oak leaves and pine-needles giving the best protection.

Mortality in hibernation was sometimes increased by accumulation of dust. A covering of snow was essential during cold weather. Other factors being equal, well-drained hilly country was more favourable to survival.

Successful hibernation in the "transition zone" (at elevations of 7,000–9,000 ft.) depended on temperature, precipitation and exposure [*cf. R.A.E.*, A, xvi, 402]. In mild, dry springs the greatest numbers emerged in cages with a northern exposure, and in cold, wet springs in those with an eastern exposure. Winter temperatures in the northern United States and in Canada are too low for successful hibernation unless other factors are favourable. Since excess or lack of moisture was less injurious at lower temperatures, the seasonal distribution of rainfall seems to be more important than the quantity. Rainfall in spring caused high mortality among beetles that were becoming semi-active, but it was not so detrimental as snow, especially if the latter was moist and heavy.

A parasitic fungus, *Beauveria globulifera* sometimes caused a high mortality among overwintering beetles, especially after heavy snowfall or damp weather in spring with a mean temperature of 42–45°F.

Few beetles were killed during complete dormancy, the period of heavy mortality occurring when they were semi-active.

COWAN (F. T.). **Mormon Cricket Control in Colorado.**—*Circ. Colo. Ent.*, no. 57, 28 pp., 16 figs., 4 refs. Fort Collins, Colo., December 1932. [Recd. June 1933.]

An account is given of the outbreaks in north-western Colorado of the Mormon cricket [*Anabrus simplex*, Hald.], which is an important agricultural pest in the Rocky Mountain region. The most recent outbreak, which lasted from 1918 to 1931, has been the worst recorded from the point of view of both damage and duration. Control measures were inaugurated in 1923 [*R.A.E.*, A, xii, 240], but were afterwards discontinued. In August 1927, when it was found necessary in one county to check the eastward spread of the crickets by means of a tin barrier, a further campaign was organised on lines that had already

proved successful in Montana [xvii, 182]. Details are given of the work carried out in each of the years 1927–31. In 1928 it was found that calcium and sodium arsenite dusts were as effective in Colorado as in Montana, and the practicability of using them in combination with tin barriers was proved. The percentage fertility of eggs was reduced by regular dusting during the oviposition period from over 70 to under 30. In one small, isolated site in a heavily infested district, the crickets were successfully controlled on lucerne by 14 applications (from 3rd May to 15th July) of a dust of calcium arsenite and lime (1 : 3). A sodium arsenite and lime dust (1 : 4) also proved effective. The crickets have now been eliminated from the whole of the infested territory, except one mountainous and inaccessible region where dusting would only be possible by aeroplane. It is thought, however, that with present knowledge of their habits and control, the farmers should be able to hold them in check in the future.

Newton (J. H.). **The Alfalfa Weevil in Colorado.**—*Bull. Colo. Agric. Expt. Sta.*, no. 399, 19 pp., 9 figs., 1 pl. Fort Collins, Colo., February 1933.

An account is given of the bionomics and control of *Hypera variabilis*, Hbst. (*postica*, Gyll.) [*cf. R.A.E.*, A, v, 1 ; viii, 128, etc.], and all stages are described. This weevil was first reported in Colorado in 1917 [vii, 102], and by 1932 was established in 9 counties. Lucerne, red clover [*Trifolium pratense*] and sweet clover [*Melilotus*] are the only known food-plants in the State. The incubation period lasts 4–35 days, varying with temperature and moisture. Oviposition begins in early April, reaches its maximum in late May and continues sporadically until winter. The larvae from the later eggs are not numerous enough to cause serious damage to crops, but they are so much less affected by parasites and cultural practices than the main part of the brood that they may be important in the production of overwintering adults. Six isolated females kept in cages from 12th May to 28th August laid daily averages of 11–17 eggs and totals of 687–1,187 in 51–83 days. The larval period varies from 9 to 31 days (the shortest averages occurring during June and July), and the pupal stage lasts 10–14 days.

Sprays of zinc arsenite, calcium arsenate or lead arsenate, at the rate of 2 lb. to 100 U.S. gals., have given good control, but the use of lead arsenate is not advised, as lead is a cumulative poison when ingested by animals. The arsenic residue from the sprays is, however, negligible [*cf.* xiii, 242]. The Ichneumonid, *Bathyplectes curculionis*, Thoms., was present in all infested parts of the State and parasitised 80–90 per cent. of the mature larvae in many fields.

Gui (H. L.). **The Potato Scab-gnat,** *Pnyxia scabiei* (**Hopkins**).—*Bull. Ohio Agric. Expt. Sta.*, no. 524, 21 pp., 6 figs., 16 refs. Wooster, Ohio, May 1933.

An account is given of investigations begun in 1926 on the bionomics and control of *Pnyxia scabiei*, Hopk., serious outbreaks of which took place on potato in Ohio in 1910 and 1926. This Mycetophilid occurs in several of the eastern United States and is generally distributed in Ohio. Brief descriptions are given of all stages. Laboratory observations were carried out on the life-cycle, which averages 22·6 days and may be completed entirely within the tuber. The eggs (of which

45–110 may be laid by one female) are deposited singly or in clusters of up to 20, preferably in soft places on tubers, in cracks in the ground, or under loose soil particles, and hatch in an average of 4·4 days. The larval period averages 14·1 days for females and 11·4 for males, and the larvae feed on the potatoes in storage or in the field [*cf. R.A.E.*, A, xv, 670]. Injury is caused annually to tubers, seed pieces or growing stems. The injury to tubers may be slight, or it may affect the entire surface, cavities covering large areas an inch deep having been observed. The pupal period is passed in a delicate cocoon in débris or under a spun web and occupies 2–7 days. Pairing and oviposition take place soon after emergence. The fact that reproduction occurs throughout the growing season and may continue in storage indicates that several generations develop annually. The winter may be passed in the field or in storage under any conditions suitable for potatoes, though activity is greatest if both temperature and humidity are relatively high. *P. scabiei* appears to be comparatively free from natural enemies, though the Centipede, *Lithobius forficatus*, L., was found frequently on infested potatoes in the field and has several times destroyed all individuals reared in the laboratory. Various plants, including onions and parsnips, are attacked, but potatoes are apparently preferred.

P. scabiei is spread by means of seed potatoes, and is able to migrate some distance through loose soil. Uninfested seed potatoes should be used, but if they are not available, treatment with mercury bichloride or hot formalin, according to the standard recommendations for the control of potato scab (*Actinomyces scabies*), will destroy all insects present. Potatoes should not be grown for more than one year consecutively in the same field. Cultural practices and cropping systems that produce the maximum amount of organic matter in the soil afford a considerable degree of protection, this material, when abundant, being apparently preferred to the growing tubers in the later part of the season. Soil reactions above pH 5·0 are favourable to infestation, and tests also show that the larvae prefer media with this hydrogen-ion content to more acid ones [*cf.* xviii, 551]. The larvae are very resistant to submersion in water, 10 out of 30 being alive after 9 days and one after 28, so that this is considered of little practical value as a control measure [*cf.* xi, 136]. Good cultural practices constitute the most effective method of control.

BRIDWELL (J. C.) & BOTTIMER (L. J.). **The Hairy-vetch Bruchid, *Bruchus brachialis* Fåhraeus, in the United States.**—*J. Agric. Res.*, xlvi, no. 8, pp. 739–751, 14 refs. Washington, D.C., 15th April 1933.

In view of the importance in the United States of *Bruchus pisorum*, L., on peas and *B. rufimanus*, Boh., on broad beans and the recent establishment of *B. brachialis*, Fhr., on vetch [*R.A.E.*, A, xx, 225], the incidence of various other members of the genus on seeds of the leguminous tribe Vicieae is recorded, mainly as the result of interceptions by the U.S. Department of Agriculture. It is pointed out that changed commercial conditions, by making imported seeds available for market in the season in which they are harvested, have greatly increased the danger of the establishment of foreign Bruchids.

Descriptions of both sexes of *B. brachialis* and the characters by which it may be distinguished from closely allied European species of *Bruchus* and all other American Bruchids are quoted from the literature. It has been reported from New Jersey, Delaware, Maryland, the

District of Columbia, Virginia and North Carolina, and has been found infesting *Vicia villosa* (the only food-plant previously known), *V. dasycarpa*, *V. pannonica* and *V. cracca*, all of these vetches except the last being cultivated as forage. Preliminary observations were carried out on its biology on *V. villosa* in New Jersey. The eggs are laid by the overwintered females in June on the immature pods over about ¼ in. wide, a total of 3–10 generally being deposited near and parallel to the margins, though 25 or more have been observed on a single pod. Few pods, except those developing from late flowers, are free from infestation. The newly hatched larvae penetrate into the pod and begin to feed inside the seeds ; when mature, they pupate in a fibrous cocoon after a prepupal period of about 2 days. The pupal stage occupies 5–5½ days and an additional 4 are required before the adults emerge from the seeds during the latter half of July and the first part of August ; they cannot leave the pod until it dehisces. They do not reinfest seeds in storage. It is considered unlikely that infested seeds would be able to germinate.

Examination of a small representative sample of seed from the first pods to ripen revealed 80·9 per cent. infestation, and it is estimated that 1 lb. of seed containing 21,600 seeds would theoretically produce over 17,000 Bruchids. The larvae and pupae were parasitised in late July and in August by the Torymid, *Microdontomerus anthonomi*, Cwfd., the Chalcid, *Zatropis incertus*, Ashm., the Pteromalid, *Habrocytus* sp., *Eurytoma tylodermatis*, Ashm., *Eupelmus cyaniceps amicus*, Gir., and *Eupelminus saltator*, Lind., which is recorded from Bruchids for the first time.

BRIERLEY (P.). **Studies on Mosaic and Related Diseases of Dahlia.**—*Contr. Boyce Thompson Inst.*, v, no. 2, pp. 235–288, 16 figs., 41 refs. Yonkers, N.Y., 1933.

In investigations in New York State during 1930–32 on diseases of dahlias, experiments were carried out on the transmission by insects of mosaic, which occurs commonly in several of the eastern United States. It was transmitted by *Myzus persicae*, Sulz. [*R.A.E.*, A, xxi, 166], but not by *M. solani*, Kalt., *M. circumflexus*, Buckt., *Aphis rumicis*, L., *A. gossypii*, Glov., another species of *Aphis*, *Macrosiphum gei*, Koch, *Empoasca fabae*, Harr., or *Lygus pratensis*, L., except that it appeared once on a plant infested with *A. rumicis*, to which, however, *M. persicae* may have had access. The incubation period of the disease was generally 4–6 weeks, but sometimes much longer, late infections tending to show symptoms after long intervals and often not until the following season. In nature dahlias are not a preferred food-plant of *M. persicae* ; the author only observed it on them in small numbers in July and in increasing numbers during September and October, though it was common on other plants.

SIMMONS (P.) & ELLINGTON (G. W.). **Life-history of the Angoumois Grain Moth in Maryland.**—*Tech. Bull. U.S. Dept. Agric.*, no. 351, 34 pp., 10 figs., 11 refs. Washington, D.C., April 1933.

This is a final report of work on *Sitotroga cerealella*, Ol. (Angoumois grain moth), carried out, chiefly in Maryland, from 1923 to 1927 [*cf. R.A.E.*, A, xii, 169 ; xiii, 335 ; xvi, 70]. Wheat is the only crop seriously attacked in the field in this latitude, but stored maize acts as a reservoir of infestation between the wheat crops. The

adults emerge from stored grain in May and some of the females oviposit on growing grain. Maximum numbers are attained after the wheat harvest in late June and early July, and breeding is most rapid from mid-June to mid-September. There are three overlapping generations a year, and in warm years there may be four. The winter is passed in the larval stage, but only larvae that are more than half-grown normally survive. Observation of newly hatched larvae liberated on growing wheat covered with muslin bags showed that they could establish themselves before the inflorescences broke through the sheath leaves and at least a week before the flowers opened, but the percentage survival of 29,890 larvae liberated in the course of four years was only 5·7. In 1924, the first emergence of adults occurred 32–42 days after liberations of larvae in June, and almost uniformly 31 days after liberations in the first week of July. All grain and straw, which may harbour overwintering larvae, should be removed from the neighbourhood of wheat fields before 1st May.

No moths were found to emerge from grain planted in October; if any survived as larvae or pupae, the compact soil evidently prevented their escape as adults. In the laboratory none survived when the grain was planted deeper than 1½–2 ins. in damp sand; there was, however, a tendency for the larvae to leave the seeds and to form cocoons in the soil.

The flight of the adults is strong but erratic and of short duration. In the laboratory they paired more than once. A supply of drinking water prolonged their life, the longest recorded being 51 days, in December 1924. Females generally lived longer than males. In normal conditions they laid an average of 40·5 eggs each, in a humid atmosphere 51, and with a supply of drinking water 83·7. The greatest number of eggs laid by one female was 389. Oviposition reached its height in the first two days. The incubation period normally varied from 4 to 12 days, but at 60·8–64·4°F. it occupied 17 days. Mortality of larvae was greatest on hard grain, which is difficult for them to enter; without food and water they lived only 3–5 days. There appear to be four instars, the larval and pupal stages being passed in a single seed. The larval period varied from 33 to 55 days in May 1924, probably in proportion to the hardness of the seeds. The pupal period varied from 5 to 10 days in 1926, the males averaging 8·1 and the females 7·2. Of the larvae observed in 1923, 75·7 per cent. completed development. The crest of emergence of adults occurred in the second and third week after their first appearance.

Dry heat (95–98·6°F.) retarded development of the embryo and shortened adult life. The few adults that emerged at temperatures below 60°F. were sluggish. Natural enemies observed were the Pteromalid, *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), which was only encountered once in small numbers, and the mite, *Pediculoides ventricosus*, Newp.

FRIEND (R. B.). **The Birch Leaf-mining Sawfly,** *Fenusa pumila* **Klug.**—*Bull. Conn. Agric. Expt. Sta.*, no. 348, pp. 291–364, 17 figs., 4 pls., 35 refs. New Haven, Conn., February 1933.

A detailed account is given of observations during the last 5 years on the biology of *Fenusa pumila*, Klug (birch leaf-mining sawfly) and its relation to white birch (*Betula papyrifera*) and grey birch (*B. populifolia*), with particular reference to Connecticut [*R.A.E.*,

A, xix, 349]. Its history, systematic position and geographical distribution are discussed, and the morphology of the adult and larva is dealt with at some length. The following is largely taken from the author's summary: The only species of *Betula* observed to be attacked in Connecticut are *B. papyrifera*, *B. populifolia* and the introduced *B. alba* (European white birch). The larval mines in *B. populifolia* are described, the measurements of the affected area being given. The ratio of males to females among the adults reared was 40 : 60. Larvae hatched from eggs laid by unfertilised females and fed normally, but did not reach the adult stage so that their sex was not determined. Oviposition occurs only in the newly developing leaves, severe foliage injury thus being restricted to the tops of the trees. The author has never observed trees killed by *F. pumila*.

Natural enemies are not numerous and do not appear to be of much value in control. The Eulophids, *Chrysocharis pallipes*, Gahan, *Closterocerus utahensis*, Cwfd., *Derostenus fullawayi*, Cwfd., and *D. diastatae*, How., were reared from a small percentage of the larvae. Nymphs of the Pentatomids, *Podisus maculiventris*, Say, and *P. placidus*, Uhler, were predacious on the larvae in the mines, and the Reduviid, *Sinea diadema*, F., attacked the adults. *Polistes pallipes*, Lep., removed the larvae from their mines, and ants often destroyed them as they attempted to enter the soil. The eggs may be killed by nicotine sulphate and water (1 : 1,000) applied to both surfaces of the leaves twice at weekly intervals beginning about 25th May against the first generation and three times at similar intervals beginning about 3rd July against the second [*cf. loc. cit.*]

Bourne (A. I.) & Whitcomb (W. D.). **Department of Entomology.**— *Bull. Mass. Agric. Expt. Sta.*, no. 293 (Ann. Rep. 1932), pp. 28–34. Amherst, Mass., March 1933.

Work in Massachusetts during the year ending 30th November 1932 included preliminary experiments with various insecticides against the Mexican bean beetle [*Epilachna corrupta*, Muls.], which indicated that magnesium arsenate, in spray or dust form, is the most satisfactory. Though lead arsenate and calcium arsenate caused severe scorching, in most cases sufficient to kill the plants, their use may be possible, if necessary, early in the season under conditions of comparatively low temperature and humidity. Barium fluosilicate caused slight injury in mid-summer, but it may constitute a possible alternative for arsenicals in cases in which the problem of residues is concerned. Unfavourable climatic conditions were responsible for a marked decrease in the numbers of the onion thrips [*Thrips tabaci*, Lind.] in July, and a further reduction in August coincided with the abnormal abundance of predators and the appearance and spread of an entomogenous fungus throughout the Connecticut Valley region. Since Coccinellids have been reported to feed on spores of certain of the lower cryptogams, their presence may possibly explain its general distribution and rapid spread. Sprays of nicotine sulphate gave a greater and more rapid reduction in the numbers of the thrips than derrisol, though the latter left a more active residue, which retarded reinfestation, or than a rotenone dust, which probably failed to penetrate the tight axils of the onion leaves so satisfactorily as a spray.

In tests of sprays for apples, combinations of lead arsenate with various "wettable sulphurs" proved effective against scab and insects [*Cydia pomonella*, L., etc.] and avoided the injury caused to the fruit and leaves by the use of lead arsenate and lime-sulphur. Oils of paraffin and asphalt bases, varying in viscosity from 203 to 619 secs. at 70°F., applied as delayed dormant sprays, gave excellent control of the overwintering eggs of the European red mite [*Paratetranychus pilosus*, C. & F.], 55–66 per cent. of the leaf clusters being free from mites, and the number present per 100 clusters varying from 67 to 100, as against an average of more than 18,000 on untreated trees. No injury or retardation of growth was observed.

The apple maggot [*Rhagoletis pomonella*, Walsh] was more numerous and injurious throughout the entire State than in any year of its present period of abundance. The peak of emergence was later and the period of activity longer than usual. The dependence of successful control on the proper treatment of neglected trees or orchards near commercial blocks was demonstrated. Recoveries from twigs of *Macrocentrus ancylivora*, Rohw., liberated against the oriental fruit moth [*Cydia molesta*, Busck] on peaches in one county, indicated that the parasite had survived the winter of 1931–32 and had built up a considerable population the following spring. In orchards where it was liberated in 1931, a considerable reduction in early twig injury was observed in the following spring and better crops were reported at harvest. Studies of the plum curculio [*Conotrachelus nenuphar*, Hbst.] at constant temperatures of 55, 65, 75, and 85°F. were continued [*R.A.E.*, A, xx, 405] with particular reference to the influence of temperature on oviposition. As the temperature rose, the number of eggs laid increased in an approximate ratio of 1 : 5 : 9 : 12 ; at all temperatures about 75 per cent. were deposited within the first 20 days and the oviposition period lasted about 55 days. At 85°F., the maximum number of eggs laid by one female was 332 and the greatest number in one day was 22. The effects of different temperatures on the development of the immature stages and survival period of adults fed on poisoned apples were in general similar to those previously recorded [*loc. cit.*]. In an orchard experiment, sprays proved more effective than dusts in reducing damage to apples by this weevil.

Abnormally dry weather during June and July prevented any great injury to carrots by the carrot rust fly [*Psila rosae*, F.]. In the laboratory no eggs maintained at a constant temperature of 85°F. hatched, but 85–90 per cent. hatched between 55 and 75°F. No adults emerged from overwintered pupae kept at 85°F., and only 44 per cent. at 75°. The average date of emergence was 15 days later at 55°F. than at 75°F. The maximum number of eggs was laid at 75°F. [*cf.* xx, 406], but 65°F. appeared to be the optimum temperature for normal development. Tobacco dust and soot broadcast three times at weekly intervals proved very satisfactory, though when applied twice these materials gave little advantage over the untreated plots.

The abundance of the red spider [*Tetranychus telarius*, L.] on greenhouse plants increased with the temperature, so that injury to plants such as carnations may be minimised by maintaining the temperature near 50°F. during cool weather. Eggs exposed to this temperature for 57 days failed to hatch. The life-cycle from egg to adult averaged 29·1 days at 60°F., 12·4 at 70° and 7·0 at 80°, the incubation period occupying 3½–12 days and over 90 per cent.

of the eggs hatching. There was a slight development of the eggs at 50°F., varying directly with the length of exposure, so that they hatched in less time than usual on being subjected to a more favourable temperature. A single fumigation with 1½ oz. vaporised naphthalene to 1,000 cu. ft. for 6 hrs. at 80°F. with relative humidities of 90, 80, 70, and 60 per cent. gave practically perfect control of the adults and nymphs ; at 75°F., two or three fumigations (or with 90 per cent. humidity one fumigation) also proved satisfactory. At the rate of 1 oz. to 1,000 cu. ft. the control was consistently satisfactory only after three treatments. The mortality of mites exposed without naphthalene to the above humidities increased with each increase in relative humidity and with each additional exposure, two periods of 6 hours each at 80°F. and 90 per cent. relative humidity killing over 50 per cent.

WILLARD (H. H.) & WINTER (O. B.). **Volumetric Method for Determination of Fluorine.**—*Industr. Engng. Chem.*, Anal. Edn., v, no. 1, pp. 7–10, 19 refs. Easton, Pa., 15th January 1933.

WINTER (O. B.) & BUTLER (L.). **Résumé of a Method for the Determination of Fluorine.**—*J. Ass. Off. Agric. Chem.*, xvi, no. 1, pp. 105–107, 1 ref.

SHUEY (G. A.). **Report on Fluorine Compounds.**—*T.c.*, no. 2, pp. 153–155, 2 refs. Menasha, Wis., 1933.

In the first of these papers a method for the quantitative determination of fluorine is described, and in the second and third, attempts to adapt it to the determination of the fluorine content of plant material are discussed, particular reference being made in the third paper to its estimation in spray residues.

CRIDDLE (N.). **Notes on the Habits of injurious Grasshoppers in Manitoba.**—*Canad. Ent.*, lxv, no. 5, pp. 97–102, 1 fig., 5 refs. Orillia, May 1933.

Observations in Canada during 1931 and 1932 showed that in concentrated gatherings of *Camnula pellucida*, Scud., the grasshoppers were much yellower in colour and more slender than the normal solitary forms. Mass migrations of hoppers and swarm flights of adults occurred, as in a true swarming phase. In *Melanoplus bivittatus*, Say, the swarming phase, first observed in 1932, differed from the solitary phase by the more slender body and longer wings, and a lighter colour and slightly longer wings were also noticed in *M. packardi*, Scud., in Saskatchewan, where it was very abundant. The swarming phase was not well defined in any of these three species, and transformation from the solitary to the swarming phase seemed to stop at a transition stage.

Diseases, parasites and predators of grasshoppers were scarce in 1931, but increased in 1932. In many instances local congregations of grasshoppers were almost entirely destroyed by *Sarcophaga kellyi*, Aldr., while the combined activities of the Bombyliid, *Systoechus vulgaris*, Lw., and several species of blister beetle and Carabid larvae destroyed approximately 20 per cent. of the eggs over the entire province of Manitoba, and in some areas as many as 90 per cent. The larger egg-masses, such as those of *M. bivittatus*, suffer more

from natural enemies than the smaller ones of *C. pellucida* and *M. mexicanus*, Sauss. In certain areas of Manitoba exceptionally dry and hot weather in 1932 caused the adult grasshoppers to cease mating and oviposition, while a large number of *M. bivittatus* died, probably owing to lack of moisture. In cage experiments, the absence of succulent food, or moisture, resulted in a marked reduction in breeding activities and sometimes in death.

Although Canadian grasshoppers exhibit definite food and habitat preferences, there is no evidence of the existence of definite specific " reservations " [*cf. R.A.E.*, A, xx, 548].

HOERNER (J. L.). **The Alfalfa Webworm** (*Loxostege commixtalis* **Walker**).—*Circ. Colo. Ent.*, no. 58, 12 pp., 5 figs. Fort Collins, Colo., April 1933.

In 1932 extremely severe loss was caused in Colorado by an outbreak of *Loxostege commixtalis*, Wlk. (alfalfa webworm), which attacks a variety of plants, a list of which is given. Rather less serious outbreaks occurred in 1914 and 1920 ; they appear to follow years during which the precipitation, particularly in May and June, has been below normal. All stages are described. The adults emerge between the end of March and late June, being most numerous in early May. They are often attracted to lights. Oviposition continues for about 2 weeks, the female laying about 200 eggs, usually in groups of 2–20 on the lower surface of the leaves. The larvae hatch in 4–6 days in warm weather and feed for 4–5 weeks on the lower surface of leaves, to which they are attached by a thin web, skeletonising the foliage and finally destroying it entirely. On the larger plants they generally feed under shelter of the leaves, which they web together. When mature they construct an earthen cell, lined with silk, 1–1½ ins. below the surface, in which they pupate. Pupation does not always occur at once, and the overwintering generation does not pupate till the following spring. The pupal period occupies 2–3 weeks. In northern Colorado there are usually 3 overlapping broods, the moths occurring again in July and early September, but in 1932 pupation of first-brood larvae took place at varying intervals throughout the summer, and a considerable percentage overwintered before pupating.

Successful control of the young larvae on sugar-beet has been obtained by the application (as a fine mist) of 4 lb. Paris green or 8 lb. lead arsenate in 50 U.S. gals. water to the acre, and on carrots, parsnips, celery, maize, garden beet and small cherry trees of 3 or 5 lb. lead or calcium arsenate to 100 U.S. gals., the weaker concentration being used against larvae under ½ in. long. Infestation of these crops in May was largely due to the moths being attracted to weeds for oviposition, and clean cultivation should be practised when large numbers emerge. If a crop on which arsenical residue would be dangerous has to be sprayed within 2 weeks of marketing, 1 oz. powdered hellebore to 1 U.S. gal. water may be applied. Dusts of lead or calcium arsenate and lime are effective on cabbage and peas, to which sprays do not adhere well. Lucerne that is heavily infested should be harvested early and the field rolled with a corrugated roller to kill the larvae, or harrowed to destroy the pupae. If spraying is necessary, 1 lb. calcium arsenate to 50 U.S. gals. water may be applied. Irrigation may enable young plants to outgrow the injury.

Crops may be protected from migrating larvae by trenches, which should have sloping sides in loose dry soil or a vertical side next to the crop in firm moist soil. The larvae should be killed by poison bait in the trench, or, if it has sloping sides, by dragging a weighted log along it. Ditches are an effective barrier if the water in them is oiled. A shallow furrow lined with a mixture of about 1 lb. cement to 1 U.S. gal. water and partly filled with crude oil also prevents migration. On small plants the migrating larvae may be destroyed by means of a smooth roller; after each rolling, the soil surface must be broken up to check further migration. Invasions have also been prevented by allowing turkeys to feed in the fields.

Parasites reared from the larvae included the Tachinids, *Zenillia caesar*, Aldr., *Z. trisetosa*, Coq., *Phryxe* (*Z.*) *vulgaris*, Fall., and *Achaetoneura archippivora*, Will., and the Braconids, *Meteorus loxostegei*, Vier., and *Bracon vulgaris*, Cress., but the total rate of parasitism was only about 3 per cent.

RICHARDSON (C. H.) & HAAS (L. E.). **The relative Toxicity of Pyridine and Nicotine in the gaseous Condition to** *Tribolium confusum* **Duval.**—*Iowa St. Coll. J. Sci.*, vi, no. 3, pp 287–298, 6 figs., 23 refs. Ames, Iowa, 1932.

An investigation was carried out on the relative toxicity of pyridine and nicotine at 25°C. [77°F.] to adults of *Tribolium confusum*, Duv., 20–50 days after emergence. The beetles used were reared from eggs that were laid by adults fed on white flour with the addition of 3 per cent. brewer's yeast, the larvae developing in coarsely ground whole wheat flour in wide culture dishes. The toxicity of the gases was determined in a closed apparatus, which is fully described, its essential feature being the presence of glass throughout the portions in contact with the gas, the concentration of which was regulated by flow meters.

After exposure to the gas in batches of 50 for a recorded time, the beetles were kept with a supply of flour in a constant temperature chamber at about 25°C. [77°F.] and 60–70 per cent. relative humidity. They were examined after 24 hours and subsequently over a period of a week or so. Only 4 per cent. of 7,000 control beetles died during the period of observation. The length of exposure required for one of the compounds to kill 50 per cent. of the insects at constant concentration was determined by calculation from the toxicity data. Data for the second compound were then secured by exposing the beetles for this length of time to various concentrations. The results of the tests, which are shown in tables and graphs, indicate that the concentrations required to kill 50 per cent. of the beetles vary inversely with the length of exposure. Nicotine was on the average about 31 times as toxic as pyridine, causing 50 per cent. mortality in 360 mins. at a concentration of 0·228 mg. per litre and in 133 mins. at 0·42 mg., whereas the corresponding figures for pyridine were 8·8 and 12·9 mg. The above results were obtained at a relative humidity of 0 per cent., but considerable variations in humidity (up to 68 per cent.) did not appear to have an appreciable effect on toxicity. The toxicity of hydrocyanic acid gas has been found to be similarly unaffected [*R.A.E.*, A, xvi, 95]. As certain species of insects are known to be much more resistant to toxic compounds than others, it is unlikely that this relative toxicity will hold good for all of them.

Service and Regulatory Announcements, October–December 1932.—*U.S. Dept. Agric.*, B.P.Q., S.R.A., no. 113, pp. 95–134. Washington, D.C., March 1933.

In addition to official announcements in connection with quarantines against insect pests in the United States, many of which have already been noticed, a list is given of current quarantines applying to the United States and the territories of Hawaii and Porto Rico, including domestic and foreign quarantines and other restrictive orders, as well as a synopsis of State regulations on account of *Pyrausta nubilalis*, Hb., up to December 1932.

Cushman (R. A.). **The Identity and Synonomy of three Oriental Species of *Cremastus* (Hym., Ichneumonidae).**—*Proc. Ent. Soc. Wash.*, xxxv, no. 5, pp. 73–75. Washington, D.C., May 1933.

In view of the introduction of *Cremastus flavo-orbitalis*, Cam., from Japan into the United States against *Pyrausta nubilalis*, Hb. (European corn borer), an investigation was made of its systematic position, during which it was found that this Ichneumonid has been confused with *C.* (*Temelucha*) *japonicus*, Ashm., and *C. chinensis*, Vier., by Japanese authors. Structural characters distinguishing these three species are shown in a key. *C. flavo-orbitalis*, of which *C. biguttulus*, Munakata, and *C. hymeniae*, Vier., are synonyms, is widely distributed throughout the Oriental and Australian regions and is present in the Palaearctic region in eastern Asia. Its range extends as far west as Ceylon and India. The United States National Collection includes specimens from *P. nubilalis* and *Cydia* (*Grapholitha*) *molesta*, Busck, in Japan, *Hymenia fascialis*, Cram., and *H. recurvalis*, F., in Hawaii, and *Crocidolomia binotalis*, Zell., in the Philippines, and a series from Singapore. It has also been recorded as a parasite of *Chilo simplex*, Butl., in Japan under the name of *C.* (*Diaparsis*) *japonicus* [*R.A.E.*, A, xvii, 343].

Cremastus japonicus, is only known from the type female from China; the paratype from China is *C. flavo-orbitalis* and all subsequent records of this species appear to refer to the latter. *C. chinensis* is a parasite of *Chilo simplex* in Japan and was erroneously recorded in a paper already noticed [xviii, 510] as a synonym of *C. flavo-orbitalis* (*biguttulus*).

van Dillewijn (C.). **De periodiciteit van den witten topboorder.** [The Periodicity of the White Tip-Borer.]—*Meded. Onderafd. Cheribon Proefst. Java-Suikerind. 1932*, pp. 1–9. Cheribon, 1933. (With a Summary in English.)

Investigations in the Cheribon area of Java in 1931 and early 1932 showed that extensive flights of adults of *Scirpophaga intacta*, Sn., which are followed by serious infestation of sugar-cane by the larvae, occur at fixed intervals of two months. The oviposition period lasts several days, and the eggs hatch in about 8. The egg-parasite, *Phanurus beneficiens*, Zehnt., also occurred in numbers at intervals of two months, and the periodicity of *Scirpophaga* is probably due to the action of the parasite. When the chief flights of the moth occur, *Phanurus* is scarce, so that the first eggs laid escape parasitism. The larvae from these eggs give rise to the new flight of moths two months

afterwards. Eggs laid later are almost all parasitised, as the parasite breeds rapidly, maturing in about 10 days [*cf.* *R.A.E.*, iii, 384; xviii, 611].

van Dillewijn (C.). **Verslag van de Onderafdeeling Cheribon van het Proefstation voor de Java-Suikerindustrie over het jaar 1932.** [Report for 1932 of the Cheribon Sub-district of the Java Sugar Experiment Station.]—21 pp. Cheribon, 1933.

Work during the year included collection of data relating to *Scirpophaga intacta*, Sn., which is more injurious to sugar-cane in the Cheribon area than in any other part of Java, causing a reduction of 20–30 per cent. in the amount of sugar obtained. The moths fly readily from old cane fields to new ones, whereas *Phanurus* [*beneficiens*, Zehnt.] and other parasites are less active and spread more slowly. Parasitised material was therefore placed in the fields in cages that permitted the escape of *Phanurus* but retained the moths. Since opinions differ as to the practical value of collecting egg-masses of *S. intacta*, counts were made of the numbers of infestations resulting from a known number of egg-masses in an experimental plot of cane. The average numbers per egg-mass after 1, 2, 3, 4 and 5 months were 0, 1·3, 5·4, 6·7 and 4·3. In several cases 20 or more infestations were produced from one egg-mass, the maximum observed being 48. The periodic outbreaks of *S. intacta* on sugar-cane [see preceding abstract] were found to occur 10–14 days after flights of the moths, which are not very noticeable as they take place chiefly at night. Light traps or trap heaps of cane rubbish [*R.A.E.*, A, xi, 291] proved useless for ascertaining the date of flight, only a few moths being caught. Experiments confirmed Hazelhoff's statement that the larvae develop more rapidly in young cane than in old [xix, 568].

Southern Rhodesia. **Tobacco Pest Suppression Act, 1933.**—Fol. 6 pp. [Salisbury, Rhodesia] 1933.

This act, which provides for the control of insects, etc., that may subsequently be designated pests of tobacco in Southern Rhodesia, prohibits the removal of cured tobacco from unlicensed premises. Infested tobacco may be removed to a specified market subject to special permit. Licences may be suspended if the premises or their contents are found to be infested with a pest. The presence of a pest in such premises is notifiable, and powers are given to inspectors to examine premises. Unless specially exempted, owners of land on which tobacco is or has been growing must cleanse the soil and remove all tobacco or other plants that may be designated alternative food-plants of tobacco pests by a fixed date to be determined, and provision is made for inspection and compulsory destruction if necessary.

Northern Rhodesia. Ordinance No. 16 of 1931. **Plant Pests and Disease Ordinance, 1931.**—3 pp. Livingstone, 27th March 1931. [Recd. May 1933.]

This Ordinance empowers the Governor of Northern Rhodesia to make regulations for preventing the introduction or spread within the Territory or from the Territory to any other place of any pest or disease destructive to plants.

Northern Rhodesia. Government Notice No. 22 of 1933. **The Plant Pest and Diseases Ordinance of 1931. Importation of Plants Regulations of 1933.**—9 pp. Livingstone, 10th February 1933.

These regulations prohibit the introduction of plants, parts of plants or seeds into the Territory of Northern Rhodesia except by post or through specified ports of entry. Authority is given to examine plants on introduction, and to destroy any that are diseased or infested by insects, etc. Any consignee of such plants must supply a certificate of origin on request. Lists are given of plants and seeds the introduction of which is prohibited or only permitted under certain restrictions, special regulations applying to consignments from South Africa, Southern Rhodesia and the Belgian Congo.

Sladden (G. E.). **La désinfection de la semence de café. Fumigation de la semence de café par la méthode à la térébenthine.**—*Bull. agric. Congo belge*, xxiii, no. 3, pp. 329–337, 1 ref. Brussels, September 1932. [Recd. June 1933.]

A description is given of the method used in Java for fumigating coffee seed to destroy the borer, *Stephanoderes hampei*, Ferr. [*R.A.E.*, A, xix, 193], but the dosage is here given as 1 cc. of turpentine to 100 sq. cm. of cotton, not to 100 cc. as in the original text. In tests of this method in the Belgian Congo, fumigation for 48, 72 or 96 hours caused 100 per cent. mortality of all stages, except that 2–4 per cent. of the eggs survived the shorter treatments. The 72-hour fumigation, however, was apparently vitiated in this test by defective turpentine, and this period is recommended for practical use. Nothing appeared to be gained by using greater dosages. The presence of moisture in the seeds apparently weakened the action of the fumigant. The percentage of fumigated seeds that germinated was (in two tests) 62 and 75, as against 90 in controls. Fumigation with naphthalene failed to give satisfactory control of the Scolytid.

In the course of these experiments, *Prorops nasuta*, Wtstn., not previously recorded from the neighbourhood of Stanleyville, was found parasitising *S. hampei*, and brief notes are given on the bionomics of this Bethylid [*cf.* xiv, 437 ; xvi, 165].

Moutia (A.). **Entomological Division.**—*Ann. Rep. Dept. Agric. Mauritius 1931*, pp. 9–12. Reduit, November 1932. [Recd. June 1933.]

The situation as regards *Lachnosterna* (*Phytalus*) *smithi*, Arrow, and its parasites in Mauritius during 1931 is discussed [*cf. R.A.E.*, A, xxi, 220]. Its numbers are steadily increasing, and new centres of infestation are discovered annually. A study indicated that *Tiphia parallela*, Smith, is scarce from February to April and abundant from June to August ; since during these periods the numbers of the host larvae fluctuate inversely, this may possibly explain the limited efficiency of the parasite. Another Scoliid, *Campsomeris* (*Elis*) *grandidieri*, Sauss., was imported from Rodrigues [*cf.* xx, 397], and 426 females and 73 males were liberated at various centres. In experiments to test whether *L. smithi* can breed in manure, 2,000 adults were placed in January in a manure heap having a maximum temperature above 40°C. [104°F.]. After 5 months only 13 larvae

were found. Of 40 mongoose stomachs examined, only 2 contained one larva each, indicating that, contrary to reports, this animal is not an important enemy of *L. smithi*.

Severe damage was caused to sugar-cane in several plantations by *Sesamia vuteria*, Stoll (pink borer) and *Diatraea venosata*, Wlk. (spotted borer). On coconut, *Aspidiotus destructor*, Sign., was eradicated from certain areas by a cyclone in March. An invasion of cutworms occurred from April to June, *Prodenia litura*, F., and *Spodoptera mauritia*, Boisd., being specially troublesome in vegetable and tobacco plantations. *Papilio demodocus*, Esp., was abnormally prevalent on *Citrus*, partly owing to the destruction of its natural enemies in the cyclone.

The following important pests are included in a table, which shows the plant attacked, the month and locality in which infestation occurred and in most cases the control measures recommended : *Gryllotalpa africana*, P. de B., and *Solenopsis geminata*, F., on tobacco ; the Galerucid, *Luperodes quaternus*, Fairm., and *Agromyza phaseoli*, Coq., on beans, the pupae of the latter being parasitised by the Braconid, *Opius liogaster*, Szépl. ; *Cosmopolites sordidus*, Germ., on bananas ; the Tineid, *Porpe bjerkandrella*, Thnb., on artichoke ; *Agrotis ypsilon*, Hufn., on vegetables ; the adults of the Rutelid, *Adoretus versutus*, Har., on rose ; *Aphis tavaresi*, Del G., on *Citrus* ; the Pierid, *Catopsilia grandidieri*, Mab., and the Sphingid, *Deilephila* (*Daphnis*) *nerii*, L., on *Cassia florida* ; the Pyralids, *Etiella zinckenella*, Tr., and *Maruca testulalis*, Geyer (which also attacks beans), the Lycaenid, *Lampides* (*Polyommatus*) *baetica*, L., and the Noctuid, *Pardasena virgulana*, Mab. (the larvae of which pupate on the leaves in silken cocoons), all on *Cajanus indicus* ; *Cylas formicarius*, F., on sweet potato ; the adults of *Platypus truncatus*, Chapuis, and *Xyleborus* (*Eccoptopterus*) *sexspinosus*, Motsch., boring in freshly cut planks of *Eugenia jambolana* ; *Serica* sp., *Cirphis loreyi*, Dup., and *Cratopus punctum*, F., on sugar-cane ; *Saissetia hemisphaerica*, Targ., on *Sechium edule* ; and the Pyralid, *Crambus emmerezellus*, de Joannis, attacking lawns.

Since its first liberation in 1928 [xvii, 100], *Dactylopius opuntiae*, Ckll. (*tomentosus*, auct.) has become widely distributed over the Island ; prickly-pear [*Opuntia tuna*] has been eradicated from large areas, and liberations are being continued.

Zolotarevsky (B. N.). **Le riz et les sauterelles à Madagascar.**—*Riz et Rizicult.*, iv, fasc. 2, pp. 87–94, 2 pls. Paris, April 1930.

In Madagascar, rice-fields situated in the midst of forests are often damaged by migrating adults of *Locusta migratoria capito*, Sauss., but are usually free from hoppers, which hatch in the drier grasslands. The rice-fields in the latter are liable to be invaded by hoppers, but are seldom attacked by the adults, since the latter almost always settle on drier ground if it is available.

The organisation of locust control in Madagascar is described.

Chiaromonte (A.). **Considerazioni entomologiche sulla coltura della canna da zucchero nella Somalia Italiana.** [Entomological Notes on Sugar-cane Growing in Italian Somaliland.]—*Agric. colon.*, xxvii, no. 5, pp. 220–222. Florence, May 1933.

Of recent years sugar-cane has been cultivated on about 1,500 acres in Italian Somaliland. The only insect pests attacking it are

Termes classicus, Sjöst., which causes very slight damage to the slips, and *Trionymus sacchari*, Ckll., which is not abundant and is preyed upon by the larvae of a Milichiid, *Leucopis* sp. The Coccinellid, *Cryptolaemus montrouzieri*, Muls., was imported from Egypt against this mealybug, but failed to destroy it, owing to its sheltered position within the leaf-sheaths.

The Importation of Plants Order of 1933.—*S.R.O.*, 1933, no. 558, 8 pp. London, 7th June 1933.

This Order, which came into operation on 15th July 1933, amends and consolidates existing regulations affecting the importation of plants, etc., into England and Wales. All consignments of living plants and parts thereof (except seeds) for planting, and all potatoes, must be certified by the authorities of the country in which they are grown to have been found within 14 days of shipment healthy and free from evidence of any insect destructive to agricultural or horticultural crops. This requirement is not limited as in the previous regulations to plants " with a persistent woody stem above ground." Plants grown in France must also have a certificate that the Colorado potato beetle [*Leptinotarsa decemlineata*, Say] has not been known to exist within 200 km. of the place where they were grown [*cf. R.A.E.*, A, xix, 657]. The importation, and, except under licence, the transhipment in ports, of potatoes grown in the United States, Canada or France is prohibited.

Between 15th March and 14th October raw vegetables or cider apples grown in France must be accompanied by a certificate that *L. decemlineata* has not been known to exist within at least 200 km. of the place where they were grown, and those grown in any other European country by a certificate of origin. The restrictions first imposed in 1930 on the importation of raw apples grown in the United States are maintained, and between 7th July and 15th November these may be imported only when certified to be of one of the two highest grades recognised by the Federal Department of Agriculture.

The Destructive Insects and Pests Order of 1933.—*S.R.O.*, 1933, no. 557, 3 pp. London, 7th June 1933.

This Order, which came into operation on 15th July 1933, prohibits except under licence from the Ministry of Agriculture and Fisheries, the keeping, sale or release in any stage of its existence of any insect of a species destructive to agricultural or horticultural crops, or to trees or bushes, which at that date was not established in Great Britain. Provision is made for inspection if the presence of an introduced pest is suspected and for the enforcement of control measures.

Donisthorpe (H.). *Ips* (=*Tomicus*) *suturalis* **Gyll. in Windsor Forest.**—*Ent. Mon. Mag.*, lxix, no. 828, pp. 105–106. *Dendrosoter protuberans* **Nees. (Doryctinae, Braconidae), a Species of Hymenoptera Parasitica new to Britain.**—*T.c.*, no. 830, p. 153. London, 1933.

In the first paper the author records the discovery in Britain in 1931 of considerable numbers of a rare Scolytid, *Ips suturalis*, Gyll., in the bark of a fallen spruce tree, and in the second states that from

this material were bred several individuals of the Braconid, *Dendrosoter protuberans*, Nees, which is new to Britain but is known as a parasite of several other bark-beetles in various countries in Europe.

Benson (R. B.). *Diprion polytomum* **Htg., a Sawfly not previously recorded from Britain.**—*Ent. Mon. Mag.*, lxix, no. 830, pp. 153–154. London, July 1933.

In view of the serious damage caused to spruce in Quebec by *Diprion polytomum*, Htg. [*R.A.E.*, A, xx, 590], it is reported that a mature larva from which a female was reared, was taken in Hampshire in 1906 and that another individual was collected in the same county in 1912. It is not considered indigenous, as its only known food-plant is the introduced spruce [*Picea*].

Fletcher (T. B.) & Stringer (H.). **The Mystery of " The Little Black."** (*Chrysoclista atra*, **Haworth.—Lep., Cosmopterygidae.**)—*Ent. Rec.*, xlv, no. 6, pp. 86–90. London, June 1933.

A review is given of the literature on the identity of four closely allied Tineids, *Chrysoclista* (*Blastodacna*) *atra*, Haw., *C. hellerella*, Dup., *C. putripennella*, Zell., and *C. vinolentella*, H.-S., regarding which much confusion exists [*cf. R.A.E.*, A, xix, 135, 136; xx, 370, etc.]. Characters distinguishing them are shown in a key, though it is suggested that *putripennella* may possibly be merely a form of *hellerella*. All are tentatively referred to the genus *Chrysoclista*, of which *Blastodacna* is regarded as a synonym. *C. atra*, which feeds on apple, occurs in Britain and northern France, though it does not seem to be recognised on the continent of Europe. *C. hellerella*, which feeds on hawthorn [*Crataegus*], also occurs in Britain and France, but the other two species are only known on the Continent, *C. vinolentella* possibly only in Germany.

King (L. A. L.) & Meikle (A. A.). **A Fly Pest of Timothy Grass.**—*Nature*, cxxxi, no. 3319, p. 837, 5 refs. London, 10th June 1933.

Flies bred from larvae responsible in 1931 for a partial stripping of the heads of timothy grass (*Phleum pratense*) before they left the sheath, and others collected in the adult stage in the same locality in Scotland in 1932, were identified as the Cordylurid, *Amaurosoma armillatum*, Zett. Some of the flies paired and oviposited on timothy in the laboratory, and the eggs, which were similar to those collected in the field, are briefly described. They were laid singly (usually not more than one on a plant) at the base of a leaf-blade, just above the ligule, of grasses on which the flower-head had not yet appeared and hatched in 4–5 days. The larvae migrated to the heads between the edges of the folded leaves, or in one case by perforating them, and worked round the inflorescence and downwards, consuming the flower-buds and severing the glumes, as much as one-third of the head sometimes being stripped. When full-grown they dropped to the ground and pupated immediately below the surface of the soil among the roots, where they pass the winter. There appears to be only one generation a year.

Loughnane (J. B.). **Insect Transmission of Virus A of Potatoes.**—*Nature*, cxxxi, no. 3319, pp. 838–839, 5 refs. London, 10th June 1933.

Other workers in Ireland have shown that crinkle disease of potatoes is caused by the combination of the virus of simple mosaic, which is transmissible by needle inoculation, and one designated "virus *A*," which is not transmissible by this means. When attempts were made to transmit the virus complex by means of *Myzus persicae*, Sulz., only a mild form of veinal mosaic appeared, which proved different from the simple mosaic in that it produced acronecrosis when grafted on two other varieties of potato and vein-banding when inoculated by needle into tobacco. Attempts to transmit it to *Datura stramonium* by grafting or inoculation or by the feeding of the Aphid, produced no visible symptoms. These manifestations are characteristic of virus *A*. The transmission of simple mosaic by grafting to plants infected with the aphis-transmitted disease resulted in the development of typical and persistent symptoms of crinkle. Virus *A* was also transmitted direct from an infected variety of potato by *M. persicae*, resulting, as in the previous experiment, in the production of mild veinal mottling on one variety of potato, acronecrosis in two others, vein-banding in tobacco and crinkle in potato already infected with simple mosaic.

It is therefore apparent that *M. persicae* is an efficient vector of virus *A* from potato to potato and tobacco and that it transmits crinkle disease selectively [*cf.* *R.A.E.*, A, xx, 63] to the exclusion of the simple mosaic element. Virus *A* is distinct from Smith's virus *Y*, which was readily returned by inoculation from tobacco to potato, in which it produced crinkle and leaf-drop streak [xviii, 499]. Their possible association is briefly discussed.

Some evidence was obtained that *M. circumflexus*, Buckt., may also be a vector of virus *A*, but negative results were obtained with *M. solani*, Kalt. (*pseudosolani*, Theo.) and the Capsids, *Lygus pabulinus*, L., and *Calocoris bipunctatus*, F.

Darby (H. H.). **Insects and Micro-climates.**—*Nature*, cxxxi, no. 3319, p. 839, 1 ref. London, 10th June 1933.

A short account is given of work carried out with *Anastrepha ludens*, Lw. (Mexican fruit-fly) on mangos in Morelos, Mexico, in view of the suggested influence on insects of changes in temperature in small local areas due to evaporation [*R.A.E.*, B, xxi, 113]. In the wet season (June to early September) the relative humidity may continue as high as 90 per cent. for several days in July, and in the dry season (September to May) it may drop to 15 per cent. in March. This latter extreme, with the accompanying high temperature, is probably never experienced by the flies, which during the dry season are found chiefly on the lower surface of the leaves. The high rate of transpiration of the mango, which takes place almost entirely from this surface, together with the thickness of its foliage, keeps the temperature at least 10°F. lower at the centre of the tree than at the periphery, thus affording highly suitable conditions for the adult flies. Since these move little under ordinary circumstances, the very high percentage (about 99) of mango fruits infested may not be entirely due to their suitability for the eggs and larvae.

Under laboratory conditions the mortality of the Braconid, *Diachasma* (*Opius*) *crawfordi*, Vier., the chief parasite of *A. ludens*, was much higher at 20 than at 45 per cent. relative humidity, and in the field, parasitism of the fruit-fly larvae is considerably less on sweet limes than on mangos growing in close proximity, the humidity among the open-branched lime trees being very much lower.

Kisliuk (M.), jr. & Cooley (C. E.). **Summary of Results of Fruit Fly Survey in the British West Indies, 1931.**—Typescript, 86 pp. Washington, D.C., Bur. Pl. Quar., 1933.

This summary of the results of a fruit-fly survey in the British West Indies in 1931, also includes lists of the numerous other insects collected on the various islands visited, with brief notes on some of the more injurious ones.

The adult Trypetids found were: *Anastrepha acidusa*, Wlk., in Jamaica, St. Kitts, Nevis, St. Lucia, and Dominica, *A. striata*, Schin., *A. serpentina*, Wied., *A. fraterculus*, Wied., *A. ethalea*, Wlk., and *A. sylvicola*, Knab., in Trinidad, *Tomoplagia incompleta*, Will., in St. Kitts and Nevis, *Acrotaenia* sp. in Dominica and Trinidad, and *Hexachaeta amabilis*, Lw., *Blepharoneura poecilosoma*, Schin., and *Toxotrypana curvicauda*, Gerst. in Trinidad. Larvae of *Anastrepha* were found in all the above islands, feeding on the fruits of mangos, *Spondias* spp., guavas, rose apple [*Eugenia jambos*], sapodillas (*Achras sapota*), and *Inga ingoides*. Those of *A. striata* (in guavas), and *A. serpentina* (in sapodillas) were identified in Trinidad, and larvae of *T. curvicauda* were found in papayas in Trinidad and the Bahamas.

Wille (J.). **El control del pulgón lanígero del manzano mediante su parásito natural, el** *Aphelinus mali*. [The Control of the Woolly Apple Aphis by its Parasite, *A. mali*.]—*Inf. Estac. exp. agric. Minist. Fom.* [*Peru*], no. 19, pp. 6–10, 3 figs. Lima, April 1933.

Aphelinus mali, Hald., was discovered in Peru in 1930, since when it has been distributed against *Eriosoma* (*Schizoneura*) *lanigerum*, Hsm., on apple in various parts of the country. A popular account is given of its biology and that of its host.

Bondar (G.). **A lavoura cacáoeira da Bahia.** [Cacao Cultivation in Bahia.]—*Relat. Inst. Cacáo Bahia, 1932*, pp. 133–146, 3 pls. Bahia, 1933.

Very brief notes are given on several insects attacking cacao in Bahia, *viz.*, *Selenothrips rubrocinctus*, Giard., the Capsid, *Monalonion xanthophilus*, Wlk. [*R.A.E.*, A, xvii, 159], and the ants, *Atta cephalotes*, L. [xviii, 459], *Acromyrmex subterraneus*, Forel [xii, 28], and *Azteca paraensis*, Forel [xix, 117]. The fact that *Azteca chartifex*, Forel, fosters Coccids is considered to outweigh any value that it may have as a predator on cacao pests [*cf.* xv, 378].

Boselli (F. B.). **Contro l'***Ephestia cautella* **(Farfalla dei fichi secchi).** [Against the Dried Fig Moth, *E. cautella*.]—*Picentino*, lxxxix, no. 1–3, pp. 9–23. Salerno, 1933.

Investigations on the problem of infestation of dried figs by *Ephestia cautella*, Wlk., in southern Italy were begun in September 1932 in

the district of Cilento. Other pests found were *Plodia interpunctella*, Hb., *Carpophilus hemipterus*, L., *Silvanus* (*Oryzaephilus*) *surinamensis*, L., *Cathartus advena*, Waltl., and *Drosophila melanogaster*, Mg. (*ampelophila*, Lw.). In September dried figs brought into the warehouses showed only slight visible infestation by *E. cautella*, but the moths were very numerous in the warehouses themselves.

Experiments in which freshly picked figs were kept covered with gauze during the drying process, either continuously or by day or night only, showed that they are not infested on the trees or during the first 3–4 days of drying. Figs exposed by night were much more severely infested than those exposed by day. Even the figs that were continuously covered were slightly attacked by *C. hemipterus*, which may have been due either to infestation on the tree or to passage through the meshes of the gauze. It is concluded that it would be difficult to guarantee freedom from *E. cautella* by screening, and that in any case infestation by beetles and *D. melanogaster* would occur. Treatment of the figs immediately after drying and the screening of warehouses are therefore necessary. In September, with a day temperature of about 30°C. [86°F.], the eggs of *E. cautella* required at least 4½ days to hatch, and as the drying process was completed in 10–11 days, the figs were chiefly infested with eggs and also with young larvae about 2–3 days old. Larvae that were 6 days old were only 3–4 mm. long, and the injury done by them was so insignificant that it would leave no trace if they were destroyed. Newly hatched larvae usually entered the fig through the apical aperture, began feeding among the surrounding bracts, and then penetrated within, spinning a web across the aperture after 8–10 days. Occasionally, however, they entered directly through the skin. They reached maturity in 28–35 days and then emerged from the figs. They were parasitised by the Ichneumonid, *Nemeritis canescens*, Grav., and by *Microbracon hebetor*, Say (*brevicornis*, auct.).

An account is given of experiments with various methods of control, the best results being obtained, at a very low cost, by fumigation with pure carbon bisulphide, or with a mixture of 6 volumes carbon tetrachloride and 4 volumes ethyl acetate. One kg. (2·2 lb.) carbon bisulphide was used to fumigate about ¾ ton of dried figs in a box having a capacity of 1·7 cu. m. [60 cu. ft.]. Treatment lasted 60 hours, and figs kept for about 6 weeks were then found to be uninfested. An equally good result was obtained with the mixture of carbon tetrachloride and ethyl acetate used at the rate of 500 cc. per cu. m. [50 fl. oz. to 100 cu. ft.].

Malenotti (E.). **Fluorosilicato di Bario e Tipule.** [Barium Fluosilicate and Tipulids.]—*Coltivatore*, lxxix, no. 10, pp. 266–268, 1 fig. Casale Monferrato, 30th May 1933. **Fluorosilicato di bario e larve di agrotidi.** [Barium Fluosilicate and Cutworms.]—*L'Arena*, lxviii, no. 118, p. 4. Verona, 19th May 1933.

Successful experiments with a bran bait poisoned with barium fluosilicate against *Tipula oleracea*, L., in northern Italy [*R.A.E.*, A, xxi, 217] have been followed by its use in spring in tobacco fields to protect the seedlings against Tipulids. Excellent results were obtained without any scorching of the tender plants. The same bait proved effective against cutworms when strewn on the ground a few days before the tobacco seedlings were planted out.

Polizu (S.). **Din biologia păduchelui de măr** *Aphis mali* **F.** [Contribution to the Biology of the Green Apple Aphis, *A. pomi*, DeG.] [*In Rumanian.*]—*Bul. Muz. Ist. nat. Chişinău*, iv, pp. 39–44, 3 refs. Chişinău [Kishinev], 1932. [Recd. June 1933.] (With a Summary in German.)

The following is taken from the author's summary of observations in Kishinev in 1930 and 1931 on *Aphis pomi*, DeG. (*mali*, F.), which is common on apples in Bessarabia and also attacks quince: The young stem-mothers hatch from the overwintered eggs in mid-April and attack the flower- and leaf-buds and the tender tips of shoots. They mature in 12 days, moulting taking place every 3 days at a temperature of 15–17°C. [59–62·6°F.]. Their adult life lasts 10 days during which about 30 young are produced. In the course of the year there are eight generations, of which seven are parthenogenetic and viviparous, and the eighth sexual. Winged forms are present from the second generation onwards. The rate of reproduction is increased by warm dry conditions, the average number of young produced by an individual being 10 at 18–23°C. [64·4–73·4°F.] with high humidity and 30 at 31–37°C. [87·8–98·6°F.] with low humidity. Pairing and oviposition of the sexual generation begin in mid-August and, if the weather is warm, continue into October.

The only parasite observed was the Braconid, *Aphidius varius*, Nees; predators included the Coccinellids, *Coccinella septempunctata*, L., *Adalia bipunctata*, L., and *Exochomus quadripustulatus*, L., *Lasiophthicus* (*Syrphus*) *seleniticus*, Mg., *Chrysopa vulgaris*, Schn., and *Boriomyia* (*Hemerobius*) *nervosa*, F.

Karpiński (J. J.). **Korniki Puszczy Białowieskiej II.** [The Bark-beetles of the Virgin Forest of Bialowies. II.]—*Polsk. Pismo ent.*, xi (1932), pp. 52–56, 1 pl., 2 refs. Lemberg, 15th June 1933. (With a Summary in German.)

Observations on Scolytids in the forest of Bialowies [*cf. R.A.E.*, A, xix, 406; xxi, 309] were continued in 1931–32, and notes are given on 10 additional species. Of these, *Polygraphus punctifrons*, Thoms., which occurred exclusively on fallen spruce trees and spruce poles, has not previously been recorded from Poland. Other species found for the first time in the forest of Bialowies were *Hylastes cunicularius*, Er., and *H. angustatus*, Hbst., both on felled unbarked spruces, *Dryocoetes villosus*, F., on trunks of standing and fallen oak, *D. alni*, Georg, on dry or drying trunks of hazel (*Corylus avellana*) or on slender alders (*Alnus glutinosa*), and *Xyleborus monographus*, F., on oak logs. *X. xylographus*, Say (*saxeseni*, Ratz.), which is common, chiefly attacked felled oak and alder timber. *Cryphalus* (*Trypophloeus*) *asperatus*, Gyll., attacked dry standing and fallen aspen [*Populus tremula*], and *X.* (*Anisandrus*) *dispar*, F., the trunks and branches of felled oaks and alders. *Ips* (*Orthotomicus*) *longicollis*, Gyll., which was rare, infested completely dry pines, developing in the thick bark. Its galleries are different from those of any other European bark-beetle, but similar to those of some American species, including *Dendroctonus frontalis*, Zimm.

Papers noticed by Title only.

Frere (F. J.). **Determination of Fluorine in Cryolite.**—*Industr. Engng. Chem.*, Anal. Edn., v, no. 1, pp. 17–18, 16 refs. Easton, Pa., 15th January 1933.

HARRIS (M.). **Qualitative Detection of Lead in Spray Residues.**—*J. Ass. Off. Agric. Chem.*, xvi, no. 2, pp. 245–246, 2 refs. Menasha, Wis., 1933.

ESSIG (E. O.). **Nomenclature of the Vegetable Weevil.** [*Listroderes costirostris*, Schönh. (*obliquus*, Gyll.)].—*Science*, lxxvii, no. 2008, pp. 605–606, 14 refs. New York, 23rd June 1933.

BRUCK (C. R.). **New Species of** *Carphoborus* **Eich.** [*vandykei* and *swainei* in California] **with Key to Species North of Mexico (Coleoptera-Scolytidae).**—*Canad. Ent.*, lxv, no. 5, pp. 103–106. Orillia, Ont., May 1933.

KNOWLTON (G. F.) & THOMAS (W. L.). **Food Plants and Distribution of some Utah Thysanoptera.**—*Canad. Ent.*, lxv, no. 5, pp. 114–117. Orillia, May 1933.

HENDEE (E. C.). **The Association of the Termites,** *Kalotermes minor*, *Reticulitermes hesperus*, **and** *Zootermopsis angusticollis*, **with Fungi.** —*Univ. Calif. Publ. Zool.*, xxxix, no. 5, pp. 111–133, 1 fig., 12 refs. Berkeley, 12th April 1933.

CHIAROMONTE (A.). **Comparaisons entomologiques pour la culture du cotonnier entre la Colonie de l'Erythrée et la Somalie italienne.**—*Coton et Cult. cotonn.*, 1933, pp. 83–90. Paris [1933]. [Translation of *R.A.E.*, A, xx, 394.]

CHIAROMONTE (A.). **Inutilité de la désinfection sur place par la chaleur des graines de coton produites en Somalie comme moyen de lutte contre la** *Platyedra gossypiella* **Saund.**—*Coton et Cult. cotonn.*, 1933, pp. 163–167. Paris [1933]. [Translation of *R.A.E.*, A, xx, 393.]

KUNIKE (G.). **Zur Biologie des Mehlkäfers** *Tenebrio molitor* **L.** [On the Biology of the Flour Beetle, *T. molitor* (a survey of the literature).]—*Mitt. Ges. Vorratsschutz*, ix, no. 3, pp. 26–34, 36 refs. Berlin, May 1933.

[VUKASOVIĆ (P.)] VOUKASSOVITCH (P.). **Contribution à l'étude des insectes parasites entomophages.**—*Bull. int. mat. prirod. Acad. Zagreb*, 1932, pp. 8–12, 3 refs. Zagreb, 1932. [A Summary in French of a paper already noticed (*R.A.E.*, A, xx, 715).]

FELT (E. P.). **A new Enemy** [*Lobodiplosis pseudococci*, sp. n.] **of the Pineapple Mealybug** [*Pseudococcus brevipes*, Ckll., in Hawaii] **and a List of Gall Midge Enemies of Mealybugs.**—*J. N. Y. Ent. Soc.*, xli, no. 1–2, pp. 87–89. New York, N.Y., 1933.

GOUX (L.). **Notes sur les coccides de la France (5e Note). Etude d'une espéce nouvelle constituant un genre nouveau** [*Chlamydolecanium conchioides*, gen. et sp. n., in Corsica].—*Bull. Soc. ent. Fr.*, xxxviii, no. 8, pp. 119–123, 14 figs. Paris, 1933.

LAING (F.). **The Coccidae of New Caledonia.**—*Ann. Mag. Nat. Hist.*, (10) xi, no. 66, pp. 675–678, 2 figs. London, June 1933.

MAHDIHASSAN (S.). **Sex-ratio Variability and the Problems of Reproduction among Lac-insects.**—*Proc. K. Akad. Wet. Amst.*, xxxvi, no. 3, pp. 343–351, 2 pls., 16 refs. Amsterdam, 1933.

CORBETT (G. H.). **Aleurodidae of Malaya** [10 new species].—*Stylops*, ii, pt. 6, pp. 121–129, 10 figs. London, 15th June 1933.

Janiszewska (J.). **Untersuchungen über die Hymenoptere *Aphidius* sp., Parasiten der Blattlaus *Hyalopterus pruni* Fabr.** [Investigations on *Aphidius* sp., a Hymenopterous Parasite of the Aphid, *H. arundinis*, F.]—*Bull. int. Acad.*, 1932, B ii, no. 7, pp. 277–293, 1 pl., 8 figs., 9 refs. Cracow, 1933.

Descriptions are given of the egg, larva and pupa of *Aphidius* sp., a Braconid parasite of *Hyalopterus arundinis*, F. (*pruni*, F.) on plum in Poland. The eggs are laid in the Aphids at any stage after the first moult, and development is completed within the host.

Malenotti (E.). **Contro le cimici del frumento.** [Against Wheat Bugs.]—*Italia agric.*, lxx, no. 5, pp. 541–580, 35 figs., 16 refs. Rome, May 1933.

Beginning in April 1932, a very serious outbreak occurred on wheat in the province of Verona of the Pentatomids, *Aelia rostrata*, Boh. [which is apparently the species recorded in 1931 as *A. acuminata*, L. (*R.A.E.*, A, xx, 205)], and *Eurygaster maura*, L. Their hibernation habits were studied in 1932–33. Of adults of *A. rostrata* buried at a depth of 4 inches, none survived, showing that they do not hibernate in the soil. The bugs were found hibernating only in the hills, occurring singly and well hidden in tufts of wild grasses, preferably among young oaks, pines, etc. The distance between their winter-quarters and the wheat fields in the plains averaged 9–12 miles and was sometimes considerably more. Possibly some bugs remained in the hills during the summer, but none could be found in the wheat fields a month after harvest. Of 1,004 taken in the winter-quarters, 879 were *A. rostrata* (with a slight preponderance of females), and of these 392 were dead, 140 being infected with *Botrytis tenella*, which probably influences the abundance of the species more than egg-parasites. The 125 examples of *Eurygaster* included *E. maura*, *E. meridionalis*, Pén., *E. meridionalis* var. *maculata*, Mancini, and *E. hottentota*, F.; 27 were dead, but apparently death was never due to *B. tenella*.

Besides primary invasions of the wheat fields from the hills, there were secondary invasions (from infested fields to others), which could have been prevented if all primary ones had been controlled. The bugs were on the wing only during the hot hours of the day. In nature the eggs were usually laid on dry ears; and, since captive females did not oviposit on green wheat-plants but on the framework of the cages, this may be due to a colour preference. The bugs apparently died soon after oviposition. In mid-May the eggs of *E. maura* hatched in about 10 days and those of *A. rostrata* in about 12. The reproductive period lasted about 50 days, the last pairings being observed on 20th June. In both 1931 and 1932 the infestation continued for about 3 months, but in 1932 it began and ended about a fortnight later. The ripening of the wheat was retarded by only about 5 days, so that the injury it suffered was somewhat reduced, many nymphs being still present when early varieties were harvested at the end of June. Early in May the percentage of males of *A. rostrata* in the fields was 63·7, probably owing to their leaving their winter-quarters before the females. An equal proportion of the sexes would therefore indicate the presence of the main invasion.

Natural enemies observed were Scelionid egg-parasites of the genus *Telenomus*, which were of some importance in 1932, Tachinids of the genera *Phasia* and *Clytiomyia*, and an Asilid, *Heteropogon ornatipes*, Lw. No practical results were obtained by dusting with insecticides,

flooding the fields, burning stubble or the use of trap-plants or poultry. The successful use of early-maturing cereals in Italy [*cf.* xx, 489] would require earlier varieties than those at present available. The control measure found of actual value and made compulsory by a decree of 8th March 1933 is collection of the bugs in receptacles, chiefly concave trays of various kinds, pushed or dragged by one or more operators, or slung from the neck.

Among the many insects that were unusually abundant in Italy in 1931 and 1932, the Cercopid, *Tomaspis* (*Triecphora*) *sanguinolenta*, Scop. (*mactata*, Germ.), caused injury near Leghorn to grape-vines, of which it has not previously been recorded as a pest.

von Tubeuf (C. Frhh.). **Studien über Symbiose und Disposition für Parasitenbefall sowie über Vererbung pathologischer Eigenschaften unserer Holzpflanzen. i. Das Problem der Hexenbesen. ii. Dispositionsfragen für den Befall der Bäume durch Pilze und Käfer.** [Studies on Symbiosis and Susceptibility to Attack by Pests and Diseases, as well as on Inheritance of pathological Characters, in German ligneous Plants. i. The Problem of Witch Broom. ii. Questions of Susceptibility relating to the Infestation of Trees by Fungi and Beetles.]—*Z. PflKrankh.*, xliii, nos. 5–6, pp. 193–242, 60 figs. ; pp. 257–357, 18 figs. Stuttgart, 1933.

The first of these papers deals with witch broom in various trees, including brief notes on forms due to infestation by mites. In the second, detailed accounts are given by the author and his collaborators of experiments made in 1929–31 to ascertain the susceptibility of spruce to infestation by Scolytids. The beetles were caged on standing trees, some of which had been artificially injured, or with billets. Contrary to expectation, *Dendroctonus micans*, Kug., proved to be a true primary pest able to attack completely healthy trees. In 1930 *Ips typographus*, L., was able to bore into healthy trees, but died after 4–6 weeks without ovipositing. In 1931 it failed to bore into trees that had been injured artificially and had an osmotic value of 0·02–0·09 mol. KNO_3, but billets were infested in 2–4 days, and some of the beetles survived, a few larvae being also found. In nature *I. typographus* must be regarded as a secondary pest that can only attack standing trees that have suffered from prolonged drought or severe injury. *Polygraphus poligraphus*, L., was even more strictly a secondary pest, for the beetles failed to infest injured trees, any that succeeded in penetrating the bark being killed by the resin. Most of those that bored into billets were also killed by the resin. *Ips* (*Pityogenes*) *chalcographus*, L., failed to bore into healthy or injured trees, but survived in the billets. It was unfortunate that wet and cool weather prevailed during these experiments, as dry weather favours infestation by bark-beetles.

Koch (G.). **Ueber die Bedeutung der biologischen Bekämpfungsmethoden für den praktischen Pflanzenschutz.** [On the Importance of biological Control Methods in practical Plant Protection Work.]—*Z. PflKrankh.*, xliii, no. 6, pp. 358–361. Stuttgart 1933.

This paper deals primarily with the question of obtaining varieties of plants resistant to or immune from diseases and pests, but a few notes on the use of beneficial insects for biological control are included.

FINKENBRINK (W.). **Auffallende Frassbilder der Apfelmotte** *Argyresthia conjugella* **Zell.** [Injuries of an unusual Type caused by *A. conjugella*.]—*Z. PflKrankh.*, xliii, no. 6, pp. 361–364, 6 figs. Stuttgart, 1933.

A description is given of gall-like injuries in apples in Mecklenburg caused by larvae of *Argyresthia conjugella*, Zell. (apple fruit miner).

GÖSSWALD (K.) & ZWÖLFER (W.). **Das Pyrethrumkontaktgift „ Dusturan " als neues Kampfmittel gegen forstliche Grosschädlinge.** [The Pyrethrum Contact Poison, Dusturan, as a new Weapon against important Forest Pests.]—*Anz. Schädlingsk.*, ix, no. 6, pp. 72–77. Berlin, June 1933.

In Germany several contact dust insecticides are now replacing stomach poisons against forest pests. They can generally only be used successfully against smooth larvae, but a new preparation of pyrethrum (Dusturan) has proved effective against hairy larvae. When applied in the laboratory, at rates suitable for practical work, it killed all the hairy as well as the smooth larvae used. At room temperatures the larvae began falling from the food-plants within 1–5 minutes after dusting. Larvae of the sawflies, *Lygaeonematus* (*Nematus*) *laricis*, Htg., and *Diprion* (*Lophyrus*) *pini*, L., were the most susceptible to the poison. Then followed, in order of decreasing susceptibility, *Bupalus piniarius*, L., *Nygmia phaeorrhoea*, Don. (*Euproctis chrysorrhoea*, auct.), *Lymantria monacha*, L., *Porthetria* (*Lymantria*) *dispar*, L., and *Dendrolimus pini*, L. Hairy larvae took longer to die than smooth ones. Up to and including the fourth instar, 100 per cent. mortality was generally obtained with a dosage equivalent to about 44 lb. dust per acre. Against later instars higher dosages (66 or 88 lb.) will give complete control, but in practical work it would be advisable to apply the dust before the bulk of the larvae had completed the fourth instar. One advantage of a contact poison is the possibility of its use at times when larval feeding is slight. Larvae about to moult were less readily affected, but even the few that completed moulting died subsequently. When the dust was applied against the older, more resistant instars of *L. monacha* and *B. piniarius*, a small percentage pupated. The pupae of *L. monacha* produced apparently normal adults, but those of *B. piniarius* were stunted and died or yielded females only that laid a greatly decreased number of eggs. Resistance to the poison was greatest between 16 and 21°C. [60·8 and 69·8°F.] with a high relative humidity, these being the optimum conditions for the species tested. The temperature of maximum resistance varied slightly according to instar and species. For first-instar larvae of *L. monacha* it was 20–21°C. [68–69·8°F.] ; with older larvae it included rather higher figures. For the first instar of *P. dispar* it was about 19°C. [66·2°F.], and for the second about 20°C. For the third instar of *B. piniarius* it was about 21°C., and for the fifth 16–18°C. [60·8–64·4°F.]. At these temperatures the 100 per cent. mortality of the first 4 instars was reduced to 93 per cent., which suffices in practical work. As low temperatures do not affect the toxicity of this insecticide, whereas they reduce the efficiency of stomach poisons, it would be more suitable than the latter for aeroplane dusting, which is carried out in the cool morning or evening hours.

A field experiment was made in 1932 to test the action of this dust on larvae of *L. monacha*, of which 39 per cent. were in the third instar and 47 per cent. in the fourth. About 2½ acres were dusted with 110 lb. at 6 p.m., the temperature being 12·5°C. [54·5°F.] and the humidity about 90 per cent. Soon after the application light rain began and continued through the night. The first larvae fell about 10 minutes after dusting, and calculations made 15–17 hours later showed a percentage mortality of 85–95, with an average of 92.

REH [L.]. **Anobienbekämpfung.** [Measures against Anobiids.]—*Anz. Schädlingsk.*, ix, no. 6, p. 82. Berlin, June 1933.

Nitrobenzene has proved highly effective against Anobiids in furniture. Signs of boring stopped immediately or very soon after the sites of infestation were painted with it, and only in a few cases were 2 or 3 applications needed. No new injury was observed after 3–4 years. Xylamon also gave very satisfactory results against Anobiids and *Hylotrupes bajulus*, L. [*cf. R.A.E.*, A, xxi, 323].

KEMPER (H.). **Versuche mit einen festen, zur Raumentwesung dienenden Schwefelkohlenstoffpräparat.** [Experiments with a Preparation in solid Form of Carbon Bisulphide for the Fumigation of Rooms and similar Spaces.] — *Z. GesundhTech. u. Städtehyg.*, xxv, no. 6, pp. 319–326. Berlin, June 1933.

Tests with Venoxiol, a jelly-like preparation stated to contain 96 per cent. of carbon bisulphide, were made in cellars and in a fumigation chamber. The results are tabulated in detail. Fumigation for 5 hours with 450 gm. Venoxiol per 10 cu. m. space [about 1 lb. per 350 cu. ft.] killed larvae of *Tineola biselliella*, Humm., adults of *Calandra granaria*, L., and *Tribolium confusum*, Duv., and larvae and adults of *Cimex lectularius*, L., *Attagenus pellio*, L., *Tenebrio molitor*, L., *Dermestes vulpinus*, F., *Periplaneta americana*, L., and woodlice.

TESCH (B.). **T-Gas, das Mittel zur Entwesung einzelner Räume inmitten bewohnter Gebäude.** [T-Gas, the Preparation for fumigating individual Rooms in inhabited Buildings.]—*Z. GesundhTech. u. Städtehyg.*, xxv, no. 6, pp. 326–342, 5 figs. Berlin, June 1933.

T-gas, a mixture of about 10 parts of ethylene oxide and 1 part carbon dioxide, is specially suitable for fumigating rooms in inhabited houses. Ethylene oxide has great power of diffusion and a high toxicity for insects, but is much less dangerous than hydrocyanic acid gas. It does not injure articles exposed to it, except that in experiments living plants were killed and fresh fruits and some varieties of potato began to rot about 10 days after fumigation. The employment of T-gas was authorised by the German government on 26th February 1932. It cannot be used in the presence of naked lights owing to the risk of fire or explosion, the lower limit for the latter being a mixture of air with 3·6–3·7 per cent. T-gas. For large spaces the mixed gas may be released direct from steel cylinders, but for small rooms it can be conveniently produced by means of separate cylinders of ethylene oxide and carbon dioxide and a wired glass syphon tested to 28 atmospheres. The desired quantity of ethylene oxide is filled into the syphon, and the carbon dioxide is then introduced at a pressure of 4

atmospheres, regulated by a reduction valve. When, after about 2 minutes, the bubbles cease rising swiftly, the taps are closed and the syphon well shaken to mix the ethylene oxide and carbon dioxide.

SCHWARZ (H.). **Neue Schädlinge der Douglasie.** [New Pests of the Douglas Fir.]—*Z. PflKrankh.*, xliii, no. 7, pp. 417–418. Stuttgart, 1933.

Insects recorded from Douglas fir [*Pseudotsuga taxifolia*] near Vienna are the Lymexylonid, *Hylecoetus dermestoides*, L., *Sirex* sp., the larvae of a moth, probably *Coleophora laricella*, Hb., boring in the needles, the weevil, *Scythropus mustela*, Hbst., feeding on the needles at the top of a tree, and one larva of *Dioryctria* sp., probably *D. abietella*, Schiff., in an immature cone.

RIPPER (W.). **Eine neue Methode der Kolonisation der Blutlauszehrwespe.** [A new Method for establishing Colonies of the Woolly Aphis Parasite.]—*Gartenbauwiss.*, vi, p. 682, 2 figs. Berlin, 1932. (Abstr. in *Z. PflKrankh.*, xliii, no. 7, p. 427. Stuttgart, 1933.)

The method practised in Italy of distributing *Aphelinus mali*, Hald., against the woolly aphis [*Eriosoma lanigerum*, Hsm.] by placing twigs infested with parasitised Aphids on the apple trees is not satisfactory in parts of Europe where rainy weather occurs in spring and early summer. A method found successful in Styria consists in breeding the adult parasites, which are then sent by post to the place of release in small boxes containing a metal tube with a supply of sugar solution for food. In these boxes they remain alive for several weeks in cool rooms, ready for liberation on the trees when the weather is favourable. A further advantage is the avoidance of the danger of distributing canker.

BOVIEN (P.) & STAPEL (C.). **Afprøvning af Midler til Bekaempelse af Skadedyr.** [Tests of Materials for the Control of Insect Pests.]—*Tidsskr. Planteavl*, xxxix, pp. 329–348; also as *Beretn. St. Forsøgsv. Plantekult.*, no. 266. Copenhagen, 1933.

The results are given of experiments carried out with various commercial insecticides in Denmark in 1931 and 1932 against the following pests: *Hyalopterus arundinis*, F. (*pruni*, F.) and *Paratetranychus pilosus*, C. & F., on plum; *Phyllotreta* spp. on turnip; *Byturus tomentosus*, F., on blackberry; *Tetranychus telarius*, L. (*althaeae*, v. Hanst.) on strawberries; *T. tiliarius*, Herm. (*telarius*, auct.) on lime; *Hercothrips* (*Heliothrips*) *femoralis*, Reut., on *Cineraria*; *Aphis* sp. on rose; *A. fabae*, Scop., on beans; *A. pomi*, DeG., on apple; and *Pseudococcus* sp. on greenhouse plants.

SCHAEFFER (C.). **De kleine sparrenbladwesp** (*Lygaeonematus abietinus* **Chr.**) **en de sparrennaaldenuitholler** (*Epiblema tedella* **Cl.**). [The Spruce Sawfly, *L. abietinus*, and the Spruce Needle Miner, *E. tedella*.]—*Tijdschr. PlZiekt.*, xxxix, no. 5, pp. 114–119, 2 pls. Wageningen, May 1933.

Following defoliation of young spruces at Bilthoven, Holland, examination in November 1932 showed the damage to have been due chiefly to the sawfly, *Lygaeonematus abietinus*, Christ, though *Epiblema tedella*, Cl. (spruce needle miner) was also present. Cocoons of *Lygaeonematus* were numerous near the surface of the soil, but over

60 per cent. appeared to be parasitised. Records of its occurrence as a pest in Germany, Austria and Switzerland are noted, only 2 instances (in 1901 and 1902) being known from Holland. When the cocoons were exposed to warmth in the laboratory, the adults emerged and oviposited in January. In nature the larvae feed from mid-May to the second week in June, and then form their cocoons. They pupate in the following spring, and the adults emerge in April–May.

Brief notes are also given on the bionomics of *E. tedella* [*cf. R.A.E.*, A, xiv, 150], with records of injury by it in Germany and Holland. It is always present in spruce woods, but outbreaks are only occasional and of comparatively little importance.

HUS (P.). **Ziekten en beschadigingen van klein fruit (bessen, frambozen, aardbeien).** [Diseases and Injuries of small Fruits (Currants, Gooseberries, Raspberries, Strawberries).]—*Tijdschr. PlZiekt.*, xxxix, no. 6, pp. 121–161, 6 pls.; also as *Versl. PlZiekt. Dienst*, no. 70, 41 pp., 6 pls. Wageningen, June 1933.

Brief notes are given on the bionomics and control of the following pests in Holland : *Eriophyes ribis*, Nal., *Capitophorus* (*Myzus*) *ribis*, L., *Aphis grossulariae*, Kalt., *Eriosoma* (*Schizoneura*) *ulmi*, L. (*grossulariae*, Tasch.) and *Lygus pabulinus*, L., on black currants ; *E. ribis*, *Incurvaria capitella*, Cl., *L. pabulinus*, and Coccids of the genera *Lecanium* and *Pulvinaria* on red currants ; *Pteronus ribesii*, Scop., and *Bryobia* sp. on gooseberry ; *Incurvaria* (*Lampronia*) *rubiella*, Bjerk., *Byturus tomentosus*, F., *B. aestivus*, L. (*fumatus* F.), and *Otiorrhynchus singularis*, L. (*picipes*, F.) on raspberry ; and *Tarsonemus fragariae*, Zimm., *Argyroploce* (*Olethreutes*) *urticana*, Hb., *A.* (*O.*) *lacunana* var. *rooana*, Degraaf, *Peronea* (*Acalla*) *schalleriana*, L., *Sparganothis* (*Oenophthira*) *pilleriana*, Schiff., *Anthonomus rubi*, Hbst., *Rhynchites aenovirens* ab. *minutus*, Hbst., and *Otiorrhynchus sulcatus*, F., on strawberry.

MARCH (A. W.). **Observations on Termites of East China.**—*Lingnan Sci. J.*, xii, Suppl., pp. 157–163, 1 pl. Canton, 22nd May 1933.

The following termites were found to be common and widely distributed in Hangchow and elsewhere in northern Chekiang :—*Coptotermes formosanus*, Shir., *Reticulitermes chinensis*, Snyder, *R. flaviceps*, Oshima (?), *Termes formosanus*, Shir., and *Macrotermes barneyi*, Light. *C. formosanus* caused most damage in buildings, though both species of *Reticulitermes* were very destructive in the apparently fewer localities where they were established. Two native traps for use in or near infested houses are described. One consists of an inverted jar, baited with pine-wood and cones and placed on the ground, which is examined for termites at intervals of 6 months or more. The other is a hole about 4 ft. deep, which in spring is filled with pine-wood and covered with dirt, so that in winter termites are attracted to it for hibernation.

PIEL (O.) & COVILLARD (—). **Contribution à l'étude du** *Monema flavescens* **Wkr. et de ses parasites.**—*Notes Ent. chin. Mus. Heude*, fasc. x, 44 pp., 13 figs., 1 pl., 16 refs. Shanghai, 10 March 1933; also in English in *Lingnan Sci. J.*, xii, Suppl., pp. 173–202. Canton, 22nd May 1933.

Brief descriptions are given of all stages of the Limacodid, *Monema* (*Cnidocampa*) *flavescens*, Wlk., which occurs in considerable numbers in

Tonkin, China and Japan and has been introduced into the United States [*R.A.E.*, A, xi, 413]. In northern China the larvae attack walnut, plum, peach, persimmon and many other trees, feeding generally on the lower surface of the leaves and sometimes causing very serious injury. Two overlapping generations a year were observed; first-brood larvae hatched in June, and some were forming cocoons on the trees as early as 15th July, whereas others were still feeding on 24th August, when a few of the second brood had already hatched.

In China the parasite best adapted for the control of this Limacodid is probably *Chrysis shanghaiensis*, Smith [*cf.* viii, 310], which occurs also in India, Siam and the Netherlands Indies, where the host is unknown. All stages are described. The female, after piercing a cocoon of *M. flavescens* with her mandibles, paralyses the larva, lays an egg and plugs up the hole. As many as 8–10 cocoons may thus be parasitised by one female. Several eggs are sometimes laid in one cocoon, but never more than larva survives. Unfertilised eggs apparently sometimes hatched. The larva hatched after 2 days; after completely devouring its host, it formed a cocoon inside the host-cocoon, and after a prepupal period of 6–10 days the pupal stage lasted a further 10–11 days. Emergence generally took place 1½–2 days later, but was often delayed for several days. Two generations were observed, adults of the first emerging late in June, about 2 weeks before any cocoons of *M. flavescens* were available, and those of the second about 2 months later.

Another parasite or hyperparasite observed was *Eurytoma monemae*, Ruschka, which was only observed to oviposit in cocoons of *M. flavescens* through punctures already made by *C. shanghaiensis* or artificially. Three generations a year were observed. Larvae that had overwintered in the host-cocoon pupated late in June, and the adults emerged in the first 3 weeks of July; those of the first generation emerged early in August, and the second at the beginning of October. More than 70 often emerged from one host-cocoon, and rarely less than 10. Pairing took place on the day of emergence. The eggs hatched on the second day; the larvae reached their final instar in 8–10 days and pupated 2 days later, the pupal period lasting 5 days. It is not certain whether *C. shanghaiensis* ever survives in cocoons afterwards parasitised by *E. monemae*.

Occasional instances have been observed of parasitism of the moth by an Ichneumonid, *Cryptus* sp. The Tachinid, *Chaetexorista javana*, Br. & Berg., introduced from Japan into Massachusetts for the control of *M. flavescens* [xx, 218], has not been recorded from China.

HART (P. C.). **De topboorderschade bij 2883 POJ.** [Tip-Borer Injury in 2883 POJ Cane.]—*Arch. Suikerind. Ned.-Ind.*, 1933, no. 9, pp. 301–314; also as *Korte Meded. Proefst. Java-Suikerind.*, 1933, no. 9. Pasoeroean, 1933.

In Java in 1931 and 1932 the percentage of infestation of one variety of sugar-cane (2883 POJ) by *Scirpophaga intacta*, Sn., amounted to 77 of that of the chief variety (2878 POJ) [*cf. R.A.E.*, A, xix, 568, etc.]. Since the loss in the former was about two-thirds that in the latter, the smaller loss in 2883 POJ is due not merely to the lower percentage of infestation but also to the quality possessed by this cane of exhibiting a smaller decrease in sugar-yield following infestation.

LABOISSIÈRE (V.). **Resultats scientifiques du voyage aux Indes orientales néerlandaises de LL. AA. RR. le prince et la princesse Leopold de Belgique. Coleoptera, Galerucinae.**—*Mém. Mus. Hist. nat. Belg.*, iv, fasc. 4, hors série, pp. 145–184, 2 pls. Brussels, 30th September 1932.

This list includes *Arthrotus phaseoli*, sp. n., recorded, with its varieties, as a pest of *Phaseolus* in Tonkin.

VAYSSIÈRE (P.). **La lutte contre les sauterelles ; son organisation internationale. Observations biologiques sur le criquet migrateur et le criquet pèlerin.**—*C. R. Acad. Agric. Fr.*, xix, no. 22, pp. 801–810, 10 refs. Paris, 1933.

The author describes the international and French organisations for anti-locust research, reviews recent literature on the locust problem, and continues the account of his laboratory experiments on *Schistocerca gregaria*, Forsk. [*R.A.E.*, A, xx, 504]. Locusts that hatched in the laboratory in April 1932 and were kept under ordinary laboratory conditions became adult in June but did not reach sexual maturity until February 1933, but those placed in very humid and warm conditions produced up to 3 generations during that period.

CHIAROMONTE (A.). **Aspetti entomologici della coltura del Cotone nella Colonia Eritrea.** [The Entomological Aspects of Cotton Cultivation in the Colony of Eritrea.]—*Agric. colon.*, xxvii, no. 6, pp. 289–292. Florence, June 1933.

In this further account of the cotton pests of Eritrea [*R.A.E.*, A, xviii, 452 ; xix, 471, 686 ; xx, 394], lists are given of the various pests attacking the different parts of the cotton plant, with notes on their presence or absence in that Colony.

EGGERS (H.). **Zur paläarktischen Borkenkäferfauna.** [On the Palaearctic Bark Beetle Fauna.]—*Ent. Bl.*, xxix, no. 2, pp. 49–56. Berlin, 30th June 1933.

The new species described include *Ips* (*Pityogenes*) *porifrons* from *Pinus halepensis* in Cyprus.

BUA (G.). **Esperimenti del 1932 con sostanze attrattive per la Mosca delle olive.** [Experiments in 1932 with Substances attractive to the Olive Fly.]—*Ann. R. Ist. sup. agrar. Portici*, (3) vi, pp. 56–77. Portici, 1933.

In 1931, experiments with poison-baits against the olive fly, *Dacus oleae*, Gmel., indicated that ammonium fluoride was specially attractive [*R.A.E.*, A, xx, 383]. In 1932 it was sought to establish whether the attractiveness was due solely to the ammonium fluoride, or to its combination with molasses, or occurred with ammonium salts generally. In one district a series of tests was made with pans filled with either 3 per cent. ammonium fluoride, 5 per cent. ammonium hydrate, 3 per cent. ammonium carbonate, 10 per cent. Dachicida F. 1931 containing molasses and ammonium fluoride [*loc. cit.*], 10 per cent. Dachivoro D.F., a similar type of commercial bait containing ammonium sulphate as well, or 10 per cent. of a bait of molasses and arsenic. Attractiveness was gauged by the number of flies found in the pans. The

results show that Dachivoro D.F. and the ammonium salts, especially the fluoride and the hydrate, were superior to the molasses-arsenic bait and to Dachicida F. 1931.

MARTELLI (G. M.). **Nota preliminare sui parassiti animali dell' *Orobanche* della fava, *Orobanche speciosa*, D.C.** [A preliminary Note on the Animal Enemies of *O. speciosa* parasitising Beans.]—*Riv. Pat. veg.*, xxiii, no. 5–6, reprint 8 pp., 9 refs. Pavia, 1933.

Orobanche speciosa is a very serious saprophytic parasite of broad beans (*Vicia faba*) in Italy and Sicily. A list is given of records in Italy of its infestation by insects and worms. In 1930–32 the author observed it to be attacked by the flies, *Phytomyza orobanchiae*, Kalt., the larvae of which feed on the ovules, and *Phorbia* (*Chortophila*) sp., and by a weevil, *Smicronyx cyaneus*, Gyll. *P. orobanchiae* appeared most likely to be of value in its control.

Other insects occurring on *Orobanche* in much smaller numbers were Noctuids of the genera *Phytometra* (*Plusia*) and *Agrotis*; Cetoniid beetles including *Epicometis* (*Tropinota*) *hirta*, Poda, and *Oxythyrea funesta*, Poda; the Dynastid, *Pentodon punctatus*, Villers; and a variety of the Chloropid, *Siphonella sulcicollis*, Mg.

CECCONI (G.). **Un Ditterocecidio del Grano nuovo per l'Italia, prodotto da *Haplodiplosis equestris* (Wagn.) Rübs.** [A Dipterous Gall of Wheat new to Italy produced by *H. equestris*.]—*Marcellia*, xxviii, no. 1, pp. 8–13, 1 fig., 10 refs. Naples, 20th July 1933.

An instance is recorded of a very slight infestation of wheat in Italy by the Cecidomyiid, *Haplodiplosis equestris*, Wagn., producing galls on the stems. No appreciable damage was done.

COLIZZA (C.). **Prove comparative tra insetticidi invernali.** [Comparative Tests of Winter Insecticides.]—*Note di Fruttic.*, xi, no. 7, pp. 127–133. Pistoia, July 1933.

The insecticides used in these tests in northern Italy were Neodendrin (containing 85 per cent. of paraffin hydrocarbons and 15 per cent. solvents); Fitodrin (containing 85 per cent. paraffin hydrocarbons, phenols, etc., and 15 per cent. solvents); and a stock lime-sulphur mixture (containing 9·65 per cent. of active sulphur) of density 1·161 or 20 degrees Bé. Neodendrin (7 per cent.) killed 88 per cent. of an infestation by *Parlatoria oleae*, Colv. (*calianthina*, Berl. & Leon), and *Epidiaspis pyricola*, del Guer., on pear. On apple the percentage of the scales killed by one application of Neodendrin at a 5 per cent. concentration was 91·4 and at 7 per cent., 96·94, and by 2 sprayings at 5 per cent., 94·9 and at 7 per cent., 100. On apple infested by *Aspidiotus ostreaeformis*, Curt., and *E. pyricola* the percentage killed by Neodendrin (6 per cent.) was 94; by Fitodrin (6½ per cent.) 93; and by the lime-sulphur mixture (30 parts to 100 of water) 31, which is regarded as satisfactory because the main object of using lime-sulphur is the destruction of *Fusicladium*. In another test with apple infested with *A. ostreaeformis*, *P. oleae*, and *E. pyricola* Neodendrin (6 per cent.) killed 98 per cent., and Fitodrin (7 per cent.) 96. The longer the interval between spraying and counting, the higher was the percentage of dead scales.

SMOLÁK (J.). **Fytoptosa šeřku.** [Mite-infestation of Lilac.]—*Sborn. čsl. Akad. Zeměd.*, viii, A, 109, pp. 39–50, 11 figs., 7 refs. Prague, 1933. (With a Summary in English.)

During recent years, lilac (*Syringa vulgaris*) has been severely infested in all parts of Czechoslovakia by the gall-mite, *Eriophyes löwi*, Nal., the injury caused being the same as that described from Britain [*R.A.E.*, A, xvii, 156] and resulting in malformations known as "witch broom." The disease is widely spread and occurs on both sheltered and exposed bushes. A cytological study of the infested buds showed that the mites, which live between the leaves in the buds, feed on the epidermal and subepidermal tissues. They are sluggish at low temperatures but become very active at higher ones, when they readily migrate to neighbouring buds, twigs, etc. They are, however, very resistant to frost and sudden changes in temperature.

Remedial measures recommended are : improved cultivation of the bushes to render them more able to withstand the attack ; cutting off and burning of the witch brooms during the winter ; and spraying the bushes with sulphur preparations before the buds open.

NEUWIRTH (F.) & HULA (M.). **Versuche mit einigen Mitteln zur Bekämpfung der Aaskäfer.** [Experiments with certain Preparations for the Control of Silphid Beetles.]—*Z. Zuckerind. čsl. Repub.*, 1932–33, pp. 161–165, 169–174, 4 figs. ; also in Czech in *Listy cukrovarnické*, li, pp. 141 & 149. Prague, 1933.

In laboratory and field experiments against Silphid larvae on sugar-beet in Czechoslovakia, the application of a 0·5 per cent. spray of a lead arsenate preparation in colloidal solution or of a proprietary poison-bait in the form of a moistened dust gave good control of all instars. The former withstood a rainfall of nearly $\frac{1}{4}$ inch, but was washed from the leaves by one of over $\frac{3}{4}$ inch. The effectiveness of the latter was reduced by drought but not by moderate rainfall. Barium chloride proved less satisfactory than against weevils [*cf. R.A.E.*, A, xix, 428] ; a 6 per cent. solution, with the addition of 1 per cent. starch, which had a slow toxic effect on Silphid larvae, could not be used without serious risk of scorching the beet till the second or third pair of leaves had appeared, and a weaker (3 per cent.) solution gave quite inadequate control.

NEUWIRTH (F.). **Schädlinge und Krankheiten der Rübe im Jahre 1932.** [Pests and Diseases of the Sugar-beet in 1932.]—*Z. Zuckerind. čsl. Repub.*, 1932–33, pp. 209–215, 1 diagr. ; also in *Listy cukrovarnické*, li, p. 169. Prague, 1933.

The pests here mentioned have all been recorded in previous reports [*R.A.E.*, A, xx, 258, 479, 576]. The incidence of the more important of them is shown in a graph in relation to climatic conditions. The outbreaks of *Euxoa* (*Agrotis*) *segetum*, Schiff., and *Bibio* [*hortulanus*, L.] were not repeated in 1932.

OUDEMANS (J. T.). **Nederlandsche *Megastigmus*-soorten.** [Dutch Species of *Megastigmus*.]—*Ent. Ber.*, viii, no. 190, pp. 465–469. Amsterdam, 1st March 1933. [Recd. July 1933.]

An American Torymid, *Megastigmus pinus*, Parf., has been bred from seeds in cones of *Abies grandis* growing in Holland, this being the first European record.

de Fluiter (H. J.). **Nogmaals iets over het uitkomen van de imago van** *Diplostichus tenthredinum* **B. B. uit den gesloten cocon van** *Diprion pini* **(L.).** [A further Note on the Emergence of the Adult of *D. tenthredinum* from the closed Cocoon of *D. pini*.]—*Ent. Ber.*, viii, no. 191, pp. 487–493, 7 refs. Amsterdam, 1st May 1933. [Recd. July 1933.]

Examination of a number of cocoons of the sawfly, *Diprion pini*, L., confirms the author's previous statement that the exit aperture of its Tachinid parasite, *Diplostichus tenthredinum*, Br. & Berg., is prepared by the Tachinid larva [*cf.* *R.A.E.*, A, xxi, 186, 382].

Decoux (L.) & Roland (G.). **Etude de la pégomye de la betterave en Belgique en 1932.**—*Publ. Inst. Amél. Betterave, Tirlemont*, no. 4, pp. 83–142, 28 figs., 3 fldg. tables, 59 refs. Brussels, 1933.

This is a full account of work already noticed [*R.A.E.*, A, xxi, 325]. All stages of *Pegomyia hyoscyami* var. *betae*, Curt., are described, and details of its morphology and biology, mainly taken from the literature, are given. Although the damage done in Belgium was actually less than that in 1931, the area affected was considerably larger. Injury caused by the third generation, in August or September, was much more severe in fodder- than in sugar-beet, owing to the sparse foliage of the former. The total parasitism of *P. hyoscyami* in Belgium in 1932 was only 3·21 per cent., and is at present negligible.

The investigation of 1932 has shown that it is impossible to attempt the control of *P. hyoscyami* in all three generations, and that the most favourable time to destroy the flies is at the emergence of the first generation at the end of April or beginning of May, when they remain for a short period in fields where beet has been grown the preceding year before proceeding to attack newly grown beet. The best results are likely to be obtained by spraying the cereals that have succeeded the beet crop with a sweetened solution of sodium fluoride [xx, 340]. The edges of grain fields and the grass-grown ditches surrounding beet-fields should also be sprayed, as the flies of the first generation frequent them in the intervals of oviposition. Flies of the second generation, on the contrary, remain in the beet-fields entirely.

Amtliche Pflanzenschutzbestimmungen. [Official Regulations on Plant Protection.]—*NachrBl. deuts. PflSchDienst*, Beilage, v, no. 1, pp. 1–60. Berlin, 1st July, 1933.

Regulations are given for preventing the introduction of San José scale [*Aspidiotus perniciosus*, Comst.] into Germany and the Saar territory.

Cottier (W.). **The Toxicity of Arsenates.**—*N.Z. J. Sci. Tech.*, xiv, no. 5, pp. 309–316, 7 figs., 2 refs. Wellington, N.Z., April 1933.

In experiments to determine the relative toxicity under New Zealand conditions of acid lead arsenate, basic lead arsenate and calcium arsenate, cage-reared larvae of *Phytometra* (*Plusia*) *chalcites*, Esp., were fed on leaves of *Solanum nigrum* dipped in solutions of the insecticides. A typical commercial brand of each arsenate was used at concentrations of 2·4 and 1·2 gm. of powder per pint of tap water, and the calcium arsenate also at 0·6 gm., 0·5 gm. per pint of a calcium caseinate spreader being added in all the tests. The acid lead arsenate contained

32 per cent. arsenic pentoxide, the basic 26·6 per cent. and the calcium arsenate 30·9 per cent. At 1·2 gm. concentration, acid lead arsenate and calcium arsenate both killed 98 per cent. of the larvae in 10–11 days, but at 2·4 gm., calcium arsenate produced the same mortality more rapidly (7 compared with 9 days). Basic lead arsenate acted much more slowly, requiring 14 days at 2·4 gm. On a basis of equivalent arsenic pentoxide content, acid lead arsenate was the most efficient poison, and basic lead arsenate the least [*cf. R.A.E.*, A, xi, 553 ; xxi, 387]. The weight of food eaten varied inversely with the relative toxicity of the poison in which it was dipped.

RITCHIE (A. H.). **Report of the Entomologist, 1932.**—*Ann. Rep. Dept. Agric. Tanganyika 1932*, pp. 68–72. Dar-es-Salaam, 1933.

Cylas formicarius, F. (sweet potato weevil) was intercepted in Tanganyika during 1932 in sweet potatoes from Uganda, and the Bostrychid, *Dinoderus minutus*, F. (bamboo beetle) attacked cotton goods in godowns where bamboo slats had been used in the bales. Sisal was damaged by *Scyphophorus acupunctatus*, Gyll., which breeds freely in the old or decaying poled material that is normally removed and burned or slashed open vertically to permit rapid drying out. The adults tunnel in the upper third of the central unfurled leaf-spike and feed on the softer leaf pulp, severing the fibre and staining it brown. Secondary fungi may invade the spike at points of damage, and the plant may decay down to the base. This weevil causes extreme disfiguration of the decorative plant *Agave americana* var. *variegata*, but it is considered of minor importance in relation to the sisal industry under normal conditions. *Phthorimaea heliopa*, Lw., caused serious injury to tobacco nurseries, the infestation of which was attributed to old and ratooning plants in the vicinity. The maintenance of a plantation of an even age (main crop) and the adoption of clean cultivation at the end of the season are recommended. During February-March *Coffea arabica* was defoliated by *Cephonodes hylas*, L., a pest of potential importance [xx, 449]. As the period of seasonal activity coincides with that of thrips, the addition of lead arsenate to the later lime-sulphur spray or to the Bordeaux mixture nicotine combination spray [xxi, 106] is recommended ; where arsenicals are not available in quantity, hand-collection of the larvae is important.

Investigations undertaken on *Anthores leuconotus*, Pasc., are summarised. Oviposition occurs mainly beneath the bark at ground level, the larvae migrating down the superficial root tissues, where their collection necessitates the laying bare of the root system close up to the central tap root. A method of preventing this migration by protecting the stem at ground level would reduce the cost of hand-collection by at least 75 per cent. Devices suggested are aluminium shields, roofing felts, chemically treated papers, etc., or the application of lime-sulphur (32 Bé.) in water at the rate of 1 : 10, made into a paste with lime, Bordeaux paste, etc. Hand-collection should begin at the time (about 4 months after the date of emergence, which should be carefully determined) when the larvae begin to cause visible damage in the form of slight vertical cracking of the bark or raised areas together with the presence of short fibre or brown dust. Thus, if flight is observed in May, collection should be carried out from September onwards. The insertion of chemicals such as paradichlorobenzene into the holes is not recommended except where extraction of the grubs is impossible. Coffee cut back nearly to the ground in infested

areas must be thoroughly examined for larvae below the soil, even when sawn cleanly across. Old stumps are best uprooted as they are difficult to rid of infestation. Alternative food-plants of *A. leuconotus* [xxi, 364] growing in the vicinity of coffee plantations should be uprooted and burned.

Exceptionally severe damage was caused in the northern coffee areas by *Leucoptera coffeella*, Guer., many plantations being almost completely defoliated by the middle of November. Plants receiving the Bordeaux mixture recommended against *Hemileia* [xxi, 106] were able to make vigorous growth at the onset of the rains in December, but those attacked by both the miner and *Hemileia* were practically without healthy foliage. Dusts impregnated with pyrethrum extract kill the moths, but their use is not at present economically practicable. Damage to coffee by *Antestia lineaticollis*, Stål, has been greatly reduced by the proper use of the bait previously recommended [xxi, 107].

Pests that have been newly determined in the Territory include :—The Coccids, *Aspidiotus elaeidis*, March., on Ceara rubber [*Manihot glaziovii*], *Aspidiotus* (*Hemiberlesia*) *lataniae*, Sign., on guava, *Actinothrips ritchianus* Bagn., on tobacco, and *Aeolothrips varicornis*, Bagn., on onion. The parasite of *Retithrips aegyptiacus*, Marchal [xxi, 106], has been identified as a species of *Thripoctenus*, probably new.

HARRIS (W. V.). **Report of the Assistant Entomologist.**—*Ann. Rep. Dept. Agric. Tanganyika 1932*, pp. 73–75. Dar-es-Salaam, 1933.

A caterpillar attacking the leaves of coffee has been identified as *Metadrepana marantica*, Tams, and the weevil infesting those of pigeon pea [*Cajanus indicus*] in the south-east as *Gyponychus quinquemaculatus*, Hust. Another weevil, *Dicasticus funicularis*, Chevr., and the Criocerid, *Bradylema robusta*, Lac., feed on the leaves of coffee in the south-west. New pests of tea were *Heliothrips haemorrhoidalis*, Bch., and the Curculionid, *Lixus discolor*, Boh.

Cotton was infested by the Chrysomelid, *Mesoplatys ochroptera*, Stål, and the Jassid, *Empoasca benedettoi*, Paoli [*R.A.E.*, A, xxi, 60], and the examination of bolls in one district revealed an exceptionally heavy degree of infestation by pink bollworm [*Platyedra gossypiella*, Saund.] in July, due to an increase in the number of larvae in infested locules rather than in that of locules attacked. An unusually large number of pupae were observed in the bolls. New cotton-growing areas in another district showed a high incidence of stained locules in August, though *Dysdercus* was absent and *P. gossypiella* and spiny bollworm [*Earias insulana*, Boisd.] were rare.

The foliage of butter beans (*Phaseolus*) was severely attacked by species of *Systates*, *Bruchus* and *Pagria*. *Apion* sp. injured the developing pods of the earth nut (*Voandzeia subterranea*), and in the same locality *Ceroplesis signata*, Waterh., caused considerable wilting of cowpea [*Vigna*] by ringing the bark.

The mite, *Locustacarus locustae*, Ewing, was obtained from a small swarm of senile individuals of *Locusta migratoria migratorioides*, R. & F., passing Morogoro early in the year.

[HARRIS, (W. V.).] **The Mosquito Blight of Tea.**—*Planter*, i, no. 8, pp. 13 & 15. Arusha, April 1933.

The Capsid, *Helopeltis bergrothi*, Reut., which occurs on tea in the south-western highlands of Tanganyika, is observed chiefly in the

nurseries and has not as yet caused any serious damage. The eggs are laid on the young shoots, and the immature stages puncture the tips and extract the juices, causing the formation of irregular, brown, translucent patches. Numbers of *H. bergrothi* result in the shrivelling and death of the leaf, and injury to the growing points produces distortion followed by blackening and withering. Hand collection, preferably early in the morning, is recommended as being the most suitable control measure over the small areas at present being cultivated, though dilute sprays of pyrethrum extract miscible in water might be tried. Owing to the wide range of alternative food-plants, attention should be paid to the plants in the vicinity of the nursery. Control methods should be applied as soon as the rains break. Measures tending to produce vigorous bushes are of value.

HARGREAVES (E.). **Entomological Work.**—*Ann. Rep. Dept. Agric. Sierra Leone 1932*, pp. 17–20. Freetown, 1933.

In Sierra Leone the chief insect pests of *Citrus* continue to be fruit-piercing Lepidoptera [*cf. R.A.E.*, A, xviii, 98], of which the Noctuids, *Achaea catocaloides*, Gn., and *Othreis fullonica*, L., were the most important during 1932. The larvae of the former fed on the euphorbiaceous tree, *Phyllanthis discoideus* (the eggs being usually laid on trees or shrubs cut down within the preceding 2–3 years) and (in one instance) on *Alchornea cordifolia*. A larva of *O. divitiosa*, Wlk., was found on an unidentified climbing plant. Other citrus fruit-piercers were the Noctuid, *Anomis pyrocausta*, Hmpsn., the larva of which feeds on the flowers of *Triumfetta cordifolia*, and the Nymphalid, *Euphaedra* (?) *ceres*, F., on *Sorindeia* sp. The adults of *Achaea catocaloides* generally appear at the end of March, having apparently migrated from a distance. They feed at first on cashew [*Anacardium occidentale*] and then on mango and towards the end of April also on *Citrus*. Oviposition occurred early in April, and the adults emerged early in May. The next generation emerged at the end of the month and then migrated. The egg stage occupied 2 days, the larval 18, the pupal 8 and the pre-oviposition 4–5. In experiments with poison baits carried out from early April to early July, a mixture of sodium arsenite and brown sugar proved the most satisfactory. The moths were caught almost exclusively between 28th April and 2nd June, the maximum trapped in one tin on a single night being 39.

Mosaic disease of ground-nuts [*Arachis hypogaea*] was found to be transmitted by *Aphis laburni*, Kalt. [*cf. R.A.E.*, A, xxi, 136] throughout the year both in the field and in the insectary, the Aphids being present in varying numbers during the entire period. During January many were killed by the fungus, *Empusa fresenii*. It appears that 2 or 3 viruses are involved. The symptoms of the first are marked chlorosis and curling of the leaves in 4–7 days, followed by darkening of the affected leaves after the formation of an additional 4–5 ; those of the second are slight chlorosis in 12–14 days, followed by darkening after the formation of one new leaf only. The third disease, characterised by marked chlorosis except of the veins, with little or no leaf-curl, has not been clearly shown to be distinct by separate transmission. Most infections are compound ; the numbers of plants showing simple infections of the first two types are apparently about equal during the rainy season, though the second predominates in the dry season.

Argyroploce leucotreta, Meyr., attacks the fruit of avocado, the larvae causing the formation of raised black spots on the skin, beneath which

they live and pupate, emerging when the fruit is ripe. As many as 6 larvae have been found in one fruit. Early in the year several reports of swarms of *Locusta migratoria* [*migratorioides*, R. & F.] were received, but no eggs were laid, and the damage done was practically negligible. The adults were parasitised by *Sarcophaga furcadorsalis*, Rohd., and *Blaesoxipha filipjevi aequatorialis*, Rohd. [xix, 627].

OLDHAM (J. N.). **On *Howardula phyllotretae* n. sp., a Nematode Parasite of Flea Beetles (Chrysomelidae ; Coleoptera), with some Observations on its Incidence.**—*J. Helminth.*, xi, no. 3, pp.119–136, 3 figs., 17 refs. St. Albans, June 1933.

Howardula phyllotretae, sp. n., is described from various species of *Phyllotreta* in England and Germany. The only stages of the Nematode found were the larval stages and the gravid females within the body of the host. The adults occurred in the abdomen and thorax, and the larvae also in the head. Attempts to breed the parasite or to find the free-living stages or those that occur in the larvae and pupae of the host were unsuccessful. The Nematode larvae issue from the gravid female into the body cavity of the host, where they appear to feed on the fluid contents, eventually reaching a stage at which a free-living condition seems necessary for further development. At this stage they apparently penetrate into the ovaries of the female beetles, and thence reach the oviduct and are probably deposited with the eggs. In the male beetles no Nematodes were found in the reproductive organs, and it is not known how escape is effected. There was little external evidence of parasitism, but the fat-body of a parasitised insect was reduced and in some cases almost absent. The reproductive organs of both sexes also showed the effects of parasitism with a probable result of diminished fertility. According to Blunk in Germany *P. undulata*, Kutsch., is sometimes very highly parasitised by Nematodes, cases having been observed in which scarcely any oviposition of this species occurred owing to heavy parasitism.

The following figures show the numbers of beetles examined and, in brackets, the numbers infested by *H. phyllotretae*:—in British material, *P. atra*, Payk., 88 (10), *P. cruciferae*, Goeze, 86 (2), *P. nigripes*, F., 100 (10), *P. nemorum*, L., 100 (0), and *P. undulata* 100 (74); and in German material, *P. nemorum* 44 (0), *P. nigripes* 25 (1), and *P. undulata* 61 (17). The absence of parasitism in *P. nemorum* may be due to the fact that it passes its larval life within the leaf tissues, whereas the larvae of all the other species occur in the soil [*R.A.E.*, A, xvi, 616]. *P. undulata* was by far the most common species, *P. atra*, *P. cruciferae* and *P. nigripes* occurring in approximately equal numbers. One Nematode per host was most usual, but records of 17, 23 and 28 were obtained. The numbers of larvae in the beetles diminished as the season advanced until in September–October practically only adult females were found. These presumably live in the beetles during hibernation and carry the infestation over to the following year.

HODSON (W. E. H.). **Hot Water Treatment and its Application to the Control of certain Plant Pests.**—*Agric. Progr.*, x, pp. 180–183. London, 1933.

The use of hot water for the control of certain pests that infest plants in positions inaccessible to sprays or dips is discussed, reference being

made to the immersion of dormant bulbs in water maintained at 110°F. for 3 hours against the larvae of *Merodon equestris*, F. [*cf.* xxi, 366] and to the treatment of strawberry runners against *Tarsonemus fragariae*, Zimm. [xix, 373 ; xxi, 371]. Provided that the latter are not treated between about the beginning of November and the end of March and are rapidly cooled after 20–30 minutes' exposure, not more than 2 per cent. of the plants should be killed. Since the mites migrate almost exclusively by means of the runners, reinfestation in the field is extremely slow and large stocks of treated plants will probably remain practically free from infestation for years. In a standard bulb bath having a capacity of 10 cwt. of bulbs, it was found possible to treat in one operation 4–5 thousand runners in bags containing about 250 each.

KEILIN (D.) & ROBINSON (V. C.). **On the Morphology and Life-history of** *Aproctonema entomophagum* **Keilin, a Nematode Parasite in the Larvae of** *Sciara pullula* **Winn. (Diptera-Nematocera).**—*Parasitology*, xxv, no. 3, pp. 285–295, 2 figs., 2 pls., 15 refs. Cambridge, July 1933.

A detailed discussion is given of the morphology, bionomics and systematic position of *Aproctonema entomophagum*, found in England as a parasite of the Mycetophilid, *Sciara pullula*, Winn., from which it was first reported in 1917 [*R.A.E.*, A, v, 542]. The free-living stage is unusually short, and both sexes are parasitic. They generally inhabit the body cavity of the host larvae, but are sometimes carried through the pupal stage into the adult. When about to oviposit, the fertilised females escape from the fly larvae at the anterior end or from the adult through the ruptured posterior abdominal segments. No parasitised adult males were found. Parasitism delays the metamorphosis of the host.

STANILAND (L. N.). **The Treatment of Narcissus Bulbs with Hot Water.**—*J. Minist. Agric.*, xl, no. 4, pp. 343–355, 1 fig., 1 graph, 1 pl., 2 refs. London, July 1933.

These experiments were primarily directed against Nematodes, but mites and larvae of the narcissus flies, *Merodon* and *Eumerus*, were satisfactorily controlled in large bulbs by treatment at 110°F. for minimum periods of 40–80 and 85–167 mins. respectively, flowering being normal in most cases. It is pointed out that the standard treatments of 3 hours will only rarely be necessary.

BOVINGDON (H. H. S.). **Report on the Infestation of cured Tobacco in London by the Cacao Moth** *Ephestia elutella* **Hb.**—*E. M. B.* 67, 92 pp., 7 graphs, 4 pls., 43 refs. London, H.M.S.O., July 1933. Price 1*s*.

A detailed account is given of extensive investigations undertaken as the result of the sudden appearance in London tobacco stores in 1929 of *Ephestia elutella*, Hb. (cacao moth) [*cf. R.A.E.*, A, xviii, 532], which was responsible for a loss of at least £100,000 from August 1929 to August 1930. The various aspects of the survey work in the warehouses are discussed, including the possible sources of infestation and the occurrence of insects other than *E. elutella* (all stages of which are briefly described), of which only the Anobiid, *Lasioderma serricorne*, F., develops in stored tobacco The damage caused by these two species

is compared. In experimental work on the life-history of *E. elutella* [xx, 1], it was found that the larval stage normally occupied 63·3 days for males and 65·5 for females, though if a period of dormancy occurred it might be prolonged to 6–7 months ; two annual generations were occasionally observed.

A description is given of experiments on control, from which recommendations are drawn, with occasional reference to the literature. Palliative measures in the warehouses consist of general cleanliness and order, their fumigation, when empty, with hydrocyanic acid gas for 24 hours or with ethylene dioxide for 48 hours at rates of about 10 and 60–80 oz. per 1,000 cu. ft. respectively, and the supplementary use against the larvae and adults of strips of paper covered with an adhesive which, however, caught only 5·14 per cent. females.

Control measures in packed and manufactured tobacco include fumigation, the various requirements of which are dealt with. More satisfactory results are stated to be obtained during warm weather, but the practice of heating stored products at the time of fumigation so as to increase the toxicity of the fumigant by stimulating the respiratory mechanism of the insects is considered of little value, an increase in the concentration of the gas to offset the lower temperature probably being cheaper. Various fumigants are discussed, including hydrocyanic acid gas, the rate recommended being 15–20 oz. per 1,000 cu. ft. for at least 48 hours. Vacuum fumigation with ethylene oxide, which is thought to be the most effective in the case of stored products, is probably too costly for use on unmanufactured tobacco. A practical method of control is the use of low temperatures, the length of the period of treatment depending on the size of the chamber, its initial temperature, the original temperature of the tobacco, the quantity being treated and the efficiency of the cooling system. One month at temperatures below −6°C. [21·2°F.] is generally sufficient for bales, but longer may be required for hogsheads. In preliminary work treatment has resulted in an objectionable tainting with tobacco of the cold storage chambers when subsequently used for other products.

When tobacco on leaving the warehouse is inconveniently brittle, it is normally passed through a steam reconditioning machine. In experiments all eggs thus treated were killed in 10 mins. at over 70°C. [158°F.]. It is desirable that all tobacco should be so treated, at a distance from the rest of the factory which would prevent subsequent re-infestation. The packing of high grade qualities of leaf inside at least three layers of the lower grade [xix, 383] is considered economically justifiable only in the case of a small quantity of very valuable leaf. None of the prevailing methods of wrapping bales prevents infestation. A layer of thick brown paper, sealed at the overlapping edges and covered with one or two hessian wrappers, would be effective, provided that the wrappers remained intact, which could probably be achieved by packing the bales into close fitting crates.

A brief discussion on the effect of low temperatures on *L. serricorne* is appended, reference being made to the literature, and a glossary is given of entomological terms and of those used in the tobacco trade.

[**Insect Pests in New Mexico in 1931–32.**]—*43rd Ann. Rep. New Mexico Agric. Expt. Sta. 1931–32*, pp. 38–49, 4 figs. State College, N.M. [1933.]

Further experiments in New Mexico with baits for codling moth [*Cydia pomonella*, L.] are described [*cf. R.A.E.*, A, xx, 407]. Cane

sugar and malt syrup [xx, 27] continued to be the most attractive baits. Of the aromatic esters, ethyl oxyhydrate gave the highest total catch of moths, 66 in four weeks, as against 46 with iso-butyl phenyl acetate, which has hitherto proved the most effective [xix, 547]. A series of experiments were carried out with the latter and cane sugar to determine the effect of different orientations. Pans of both baits were suspended in each of four adjacent trees of approximately the same size, with similar exposures to wind, light and other variable conditions, and the bait pans were moved round so that each was directly exposed to each of the cardinal points for a given interval of time. A comparison of results, by means of a formula given in a paper already noticed [xviii, 421], showed that in all cases the attractiveness of the bait depended more on its composition than on its aspect in the tree, although it was greatest in the northern and western positions.

Comparisons were made of the control obtained with the standard spray schedule of six applications of lead arsenate and with schedules in which other materials were substituted in the last three sprays. All the supplementary insecticides and particularly sodium aluminium fluoride [cryolite], nicotine tannate, and oil pyrethrum showed promise of good control, and the arsenic trioxide residue per lb. of fruit was reduced from an average of 0·043 grain to 0·001–0·004 grain.

In tests of the toxicity of calcium cyanide and paradichlorobenzene [*cf.* xvi, 681] to the giant apple root borer [*Prionus californicus*, Motsch.], larvae of the borer were buried in artificial root-shelters, at depths varying from 6 to 24 ins., and the fumigants applied at the rates usually used for treating 5–6 year old trees. After three weeks, during which the soil temperature was 55–65°F. and irrigations were applied twice a week, it was found that neither fumigant had been toxic to larvae buried at a depth greater than one foot.

Red engine oil and white oil emulsions gave good control of San José scale [*Aspidiotus perniciosus*, Comst.] on fruit trees, whereas lime-sulphur proved unsatisfactory. Nicotine tannate was the most successful of the insecticides tried against the onion thrips [*Thrips tabaci*, Lind.].

The most abundant insect vector of disease in tomato fields was *Eutettix tenella*, Baker. The adults appeared about 15th June, reaching a maximum late in the month, by which time symptoms of "western yellow blight" were becoming evident. *Paratrioza cockerelli*, Sulc, was also present, but no "Psyllid yellows" was observed. When 5–25 adults of *E. tenella* were placed on tomato plants in cages, yellow blight developed in 10–21 days, the plants becoming dwarfed and fruitless. Young plants infested with more than 50 of the leafhoppers rapidly died. In potato fields *P. cockerelli* caused Psyllid yellows, and *Empoasca abrupta*, DeLong, etiolation and hopper-burn ; the former, although more local, was more important in lowering the crop yield. The over-wintered adults of *E. abrupta* first appeared about 25th April and were abundant by 15th May. *P. cockerelli* became active a week later and was not abundant until early June. In cage observations this Psyllid was found to have two complete generations in the season in one district. In the field, symptoms of Psyllid yellows appeared 2–3 weeks after *P. cockerelli* had begun feeding, whereas plants protected by cages remained healthy. In the greenhouse, infested plants became etiolated and abnormal but never developed typical symptoms. The feeding of the adults on the spongy mesophyll and phloem interferes

with the translocation of starch to the developing tubers. Some control of both species was obtained with Bordeaux-oil-nicotine sprays and Bordeaux dusts.

DOZIER (H. L.). **Miscellaneous Notes and Descriptions of Chalcidoid Parasites (Hymenoptera).**—*Proc. Ent. Soc. Wash.*, xxxv, no. 6, pp. 85–100, 1 fig. Washington, D.C., June 1933.

The new species of parasites or hyperparasites described from hosts of economic importance are the Eulophids, *Euderomphale quercicola* from an undescribed species of *Tetraleurodes* on *Quercus viginiana* in Louisiana and *E. vittata* from *Aleurodicus* sp. in Porto Rico; the Aphelinids, *Marietta maculatipennis* from *Aspidiotus* sp. on mahogany (*Swietenia mahagoni*) and *Vinsonia stellifera*, Westw., *Encarsia* (*Trichaporus*) *catherineae* from *Aleuroplatus* sp. on *Catalpa longissima* and *Physcus uvae* from *Aspidiotus lataniae*, Sign., on grape vine, all in Haiti; and the Signiphorids, *Thysanus louisianae* from *A. lataniae* in Louisiana, and *T. insularis* from *Lepidosaphes alba*, Ckll., on cassava in Haiti. The author discusses the synonymy of *Encarsia*, which he considers to be a synonym of *Trichaporus*.

CHAMBERLIN (T. R.). **Some Observations on the Life History and Parasites of *Hypera rumicis* (L.) (Coleoptera: Curculionidae).**—*Proc. Ent. Soc. Wash.*, xxxv, no. 6, pp. 101–109, 15 refs. Washington, D.C., June 1933.

The Curculionid, *Hypera rumicis*, L., is found in Oregon on dock (*Rumex crispus* and *R. mexicanus*) in fields of lucerne, but is not known to feed on the latter. An account is given of its bionomics. It is parasitised by the Ichneumonid *Bathyplectes exigua*, Grav., which usually parasitises *H. nigrirostris*, F. [*R.A.E.*, A, xiii, 85], the Pteromalids, *Habrocytus* sp., which feeds externally on the cocoons, and *Dibrachoides dynastes*, Först., which parasitises *H. variabilis*, Hbst. (*postica*, Gyll.) in Europe [xix, 65] and *H. nigrirostris* in the Pacific Northwest [viii, 223], and *Spilochalcis delumbis*, Cress., a solitary internal parasite of the pupa. A Eulophid, *Necremnus* sp., apparently parasitised almost 50 per cent. of a consignment collected in 1932. Its habits are similar to those of *N. leucarthros*, Nees, which parasitises *H. variabilis* in Europe [xiii, 622]. It is hardy and long-lived and some adults emerging in July could probably live through the summer and autumn and undergo hibernation before reproducing. In 1932 a few survived to 5th November.

Department of Entomology.—*Rep. Purdue Univ. Agric. Expt. Sta. 1931–32*, pp. 34–38, 3 figs. Lafayette, Ind. [1933.]

In investigations on insect pests in Indiana from 1931–32, it was found that the chief source of the spring emergence of the onion maggot [*Hylemyia antiqua*, Mg.] was piles of waste onions and onions left in the fields, and that the removal of these reduced infestation. A single dusting with barium fluosilicate (80 per cent.), alone or with an equal quantity of an inert material such as talc, at the rate of 10–15 lb. per acre, gave good control of striped and spotted cucumber beetles [*Diabrotica duodecimpunctata*, F., and *D. melanocephala*, F.], always killing 75 per cent. in 12 hours and in most tests 100 per cent. in 24

hours. Of 10 dusts tested for adhesive qualities against the cabbage-worm [*Pieris rapae*, L.], the three most satisfactory ones were 1 lb. lead arsenate, with the addition of either 3 lb. sulphur and 6 lb. hydrated lime, or 9 lb. talc or 9 lb. hydrated lime, plus 3 per cent. by weight of a light oil in each case. Experiments with a Bordeaux spray (4–6–50) and two copper-lime dusts against the potato leafhopper [*Empoasca fabae*, Harr.] on late potatoes, showed that the former was the cheapest and most effective.

The peak of oviposition of the European corn borer [*Pyrausta nubilalis*, Hb.] was 4th July as compared with 7th July in 1930. Injury may be reduced by planting maize thickly and by avoiding early planting [*cf. R.A.E.*, A, xix, 476]. By sowing on 7th June instead of 5th May, infestation per 100 plants of sweet maize was reduced from an average of about 255 borers to 6·16 (the percentage of infested and unmarketable ears being reduced from 15·25 to 0) and that of dent maize from 300 to 46. The addition of medium or heavy applications of fertiliser did not increase the infestations. Recoveries have been made of the imported parasites *Ceromasia* (*Masicera*) *senilis*, Mg., *Microgaster tibialis*, Nees [*cf.* xx, 364], and *Angitia* (*Inareolata*) *punctoria*, Rom., which have been recently liberated. Barium fluosilicate mixed with talc was more effective against *P. nubilalis* than any other dust ever tested. Applied as a spray it gave over 85 per cent. control, and though producing a mottled appearance or bleaching of the leaves, it did not apparently reduce the crop yield.

HUTSON (R.). **Two Lesser Known Pests of Peaches.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 4, pp. 221–224, 4 figs. East Lansing, Mich., May 1933.

The abnormal weather conditions of the past few years have favoured the increase in Michigan of several pests that are usually present only in small numbers. Injury has been caused to peaches by the Pentatomid, *Nezara* (*Acrosternum*) *hilaris*, Say (green stink bug), which punctures the fruit chiefly during July and August, producing depressed and unripened patches on it. The adults overwinter in leaves, weeds and other rubbish and appear during the spring, usually in the latter part of May. They attack almost any available plant, but all stages appear to prefer developing fruit. One female lays an average of about 50 eggs in groups on the leaves, and the immature bugs live gregariously for the first few days. The only control measures of any value are the elimination of breeding and of overwintering places [*R.A.E.*, A, xi, 83]. Climatic conditions during the winter affect the survival of adults [v, 367].

The peach leaf silver mite [*Phyllocoptes cornutus*, Banks] [*cf.* xx, 36] hibernates beneath the bud scales of peaches and feeds chiefly on the upper surface of the leaves. The use of lime-sulphur on dormant trees against peach leaf-curl reduces this mite to negligible numbers.

MERRITT (J. M.). **Native Parasites as a Control for the Oriental Fruit Moth.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 4, pp. 224–225. East Lansing, Mich., May 1933.

In Michigan the Oriental fruit moth [*Cydia molesta*, Busck] is attacked by 21 species of parasites of which *Glypta rufiscutellaris*, Cress., and *Cremastus minor*, Cush., have been reared in considerable numbers. The former, which is the most important and also attacks *Epiblema*

strenuana, Wlk. [*R.A.E.*, A, xix, 204], hibernates when nearly half-grown, in the host cocoon, and the adults emerge with the warm weather, usually before the host moths. The females oviposit through the twigs on larvae of the second generation, which appears about the end of June and is much more numerous than the first. The parasite has been reared in varying numbers from subsequent generations and apparently resists cold better than the fruit moth, some adults having emerged from cages under field conditions as late as 5th October. During summer the life-cycles of the host and parasite coincide. In the last 3 years 25 per cent. of the fruit moth larvae collected were parasitised, with a resulting reduction of about 40 per cent. in the infestation of peaches.

The activities of *C. minor* are affected by climatic conditions. In 1931 it was responsible for the death of 7 per cent. of the larvae taken, having appeared at the beginning of the second generation, of which it parasitised 44 per cent. of the larvae collected. In 1932, however, it was only recovered in extremely small numbers. Colonies of *Macrocentrus ancylivora*, Roh., have recently been distributed in Michigan, but the result is still inconclusive. During the past 3 years indigenous parasites have been responsible for a 30 per cent. reduction in the numbers of *C. molesta* and a slightly greater one in infestation of the fruit.

McDaniel (E. I.). **The Box Elder Bug as a Household Pest.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xv, no. 4, pp. 226–227. East Lansing, Mich., May 1933.

During the past 3 years a steady increase has occurred in Michigan in the abundance of *Leptocoris trivittatus*, Say. In September large numbers of the bugs leave their food-plants, principally box elder [*Acer negundo*] and ash but occasionally including strawberry [*R.A.E.*, A, xx, 697], apple, peach, plum and pear, and start migrating into dwellings to hibernate [*cf.* xvi, 522]. The immature stages feed throughout the summer, the distribution of the bug being apparently confined to the range of the box elder. The only practical control measures are the application of a contact insecticide when the bugs are congregating on the trunk and limbs preparatory to migrating or the complete elimination of box elder trees from the neighbourhood of houses.

Chambers (E. L.). **Insects and Plant Diseases.**—*Bull. Wisconsin Dept. Agric.*, no. 141 (*Bienn. Rep. 1930–32*), pp. 87–129, 15 figs. Madison, Wis., January 1933. [Recd. July 1933.]

Notes are given on the numerous projects carried out in Wisconsin during 1930–32, when the climatic conditions were favourable for the development and survival of unusually large numbers of a wide variety of insect pests and plant diseases. Fifty of the insects and diseases reported from nurseries are listed. The increase in abundance of the San José scale [*Aspidiotus perniciosus*, Comst.] was apparently due to the failure of its natural enemies to contend with the sudden increase in numbers that resulted from long, hot, dry growing seasons followed by mild winters. Spraying was carried out in several situations, 10,000 and 12,000 U.S. gals. respectively of a 7 per cent. miscible oil emulsion being applied to over 25,000 and over 1,000 trees and

shrubs in two towns during March and April 1932. A total of 25,000 tags [*cf. R.A.E.*, A, xix, 539] dealing with the control of pests and diseases of fruit trees were distributed. During the past two years, serious outbreaks of grasshoppers, cutworms and armyworms occurred over a larger area than at any time since 1920 [ix, 221]. A poison bait, consisting of 25 lb. bran, 1 lb. white arsenic or Paris green, and 2 U.S. qts. black strap molasses in 3 U.S. gals. water was thinly broadcast against the grasshoppers and cutworms and during the summer of 1931 controlled the most serious outbreak of the latter since 1921 before any serious damage was caused. Most of the outbreaks of armyworms were brought under control by natural enemies.

Forest pests included *Hyphantria cunea*, Drury (fall webworm), which defoliated hundreds of acres of walnut and other deciduous trees during 1931; *Bucculatrix canadensisella*, Chamb. (birch leaf-skeletoniser), which skeletonised the leaves of practically all birch in the State during the late summer and early autumn of 1932; *Ellopia fiscellaria*, Gn. (hemlock spanworm), which is present in small numbers where hemlock [*Tsuga*] is grown, though it does not cause any very noticeable damage; *Tortrix* (*Cacoecia*) *fumiferana*, Clem. (spruce budworm), which has killed many evergreens and has spread considerably; *Toumeyella numismatica*, Pettit & McD. (Scotch pine scale), which is causing the death of many trees of Jack pine [*Pinus banksiana*] throughout the northern part of the State, though in many cases it is attacked by the Coccinellid, *Hyperaspis signata*, Ol. (*binotata*, Say) [*cf.* xx, 36]; and *Tortrix* (*C.*) *argyrospila*, Wlk. (fruit-tree leaf-roller), which continues to defoliate the greater part of the large oak stands throughout the north central part of the State.

In addition to *Euscelis striatulus*, Fall. (blunt-nosed leafhopper), which transmits false blossom disease [*cf.* xix, 580; etc.], cranberry is attacked by *Rhopobota naevana*, Hb. (black-headed fireworm), *Mineola vaccinii*, Riley (cranberry fruitworm), *Peronea minuta*, Rob. (yellow-headed fireworm), *Anthonomus musculus*, Say (cranberry weevil), *Dasyneura vaccinii*, Smith (tipworm), and *Crambus hortuellus*, Hb., which was discovered for the first time but was effectively controlled in most marshes. Flooding is probably the commonest method of controlling pests of cranberry, though if the water is left too long or applied at a critical period in the development of the vine it may cause a total loss of the crop. Normally about one-fifth of a crop is destroyed by insects, though entire loss may result where an outbreak has occurred too late to be controlled. Losses due to *M. vaccinii* have been greatly reduced in many areas by liberating *Trichogramma* [*minutum*, Riley], of which more than 150,000 were obtained from California in the summer, and 50,000 were released weekly from the first week in July, when the Pyralid was ovipositing.

Scouting revealed that the European corn borer [*Pyrausta nubilalis*, Hb.] has not yet become established in the State, though three small infestations were discovered in 1931 and 1932 [xx, 527].

RICHARDS (B. L.) & BLOOD (H. L.). **Psyllid Yellows of the Potato.**—*J. Agric. Res.*, xlvi, no. 3, pp. 189–216, 7 figs., 25 refs. Washington, D.C., 1st February 1933. [Recd. July 1933.]

An attempt is made to bring together the facts so far known on the "yellows" disease of potato associated with *Paratrioza cockerelli*, Sulc

[*R.A.E.*, A, xviii, 111], and to report on some additional experimental results in this connection. In certain districts in southern and northern Utah the disease is a perennial menace, sometime destroying entire crops. During May and early June 1931, the Psyllids appeared in great numbers in all early potato-growing areas, producing severe "yellows," but they disappeared owing to the extreme heat and drought in June, and recovery from the disease was general. Serious infestation was, however, reported throughout the western slope of Colorado. Much of the information given on the incidence and symptoms of the disease, the investigations on its nature and cause, the transmission studies, and the bionomics of the pest, has already been noticed [xix, 266, 556, etc.]. The first symptoms appeared after not less than three days' feeding by nymphs, and complete development of the disease only after 36 days' continuous feeding. When the nymphs were removed after 26 days or less, the plants tended to recover. Attempts to transmit the disease in the absence of *P. cockerelli* have failed, and under Utah conditions it does not appear to be exhibited in potato plants grown from tubers taken from infested fields [*cf.* xviii, 372]. The true nature of the infective principle and the manner in which it is transmitted remain unknown.

Cook (H. T.) & Walker (H. G.). **Rose Diseases and Insects and their Control.**—*Virginia Truck Expt. Sta. Bull.*, no. 79, pp. 1053–1066, 6 figs. Norfolk, Va., 1st April 1932. [Recd. July 1933.]

Popular information is given on the common insect pests and diseases of rose in Virginia, together with specific methods for their control and a general programme.

Osborn (H.). **Leaf Hoppers injurious to Cereal and Forage Crops.**—*Circ. U.S. Dept. Agric.*, no. 241, 34 pp., 13 figs., 29 refs. Washington, D.C., October 1932. [Recd. July 1933.]

In view of the extensive losses caused in the United States to various cereals and forage crops by leafhoppers and the fact that the damage is usually overlooked or attributed to other causes, general information is given on the nature and extent of the injury to different crops, and the habits, life-histories, and natural enemies of the insects. The control measures recommended are chiefly cultural, such as the rotation of crops in order that grass should occupy certain fields for not more than one or two years ; close mowing of the grass to remove the eggs and expose the young nymphs to the direct action of the sun ; and burning the dead grass in the prairie regions in autumn or early spring to destroy the eggs and other hibernating stages. Capturing the insects in hopperdozers made of a sheet-iron strip coated with coal tar is also suggested.

Notes are given on the distribution, bionomics and control of the following more important species, with brief descriptions of the adults and nymphs in most cases :—*Draeculacephala reticulata*, Sign. (yellow-headed leafhopper) ; *D. mollipes*, Say (tenderfoot leafhopper) ; *Deltocephalus inimicus*, Say ; *Thamnotettix nigrifrons*, Forbes (black-faced leafhopper) ; *Deltocephalus striatus*, L. ; *D. sayi*, Fitch ; *Euscelis* (*Exitianus*) *obscurinervis*, Stål ; *Phlepsius irroratus*, Say ; *Cicadula sexnotata*, Fall. ; *Empoasca fabae*, Harr. (potato leafhopper) ; and *Agallia sanguinolenta*, Prov. (clover leafhopper).

Annand (P. N.), Chamberlin (J. C.), Henderson (C. F.) & Waters (H. A.). **Movements of the Beet Leaf Hopper in 1930 in southern Idaho.**—*Circ. U.S. Dept. Agric.*, no. 244, 24 pp., 11 diagr., 2 refs. Washington, D.C., October 1932. [Recd. July 1933.]

The prediction that there would be no serious outbreak of *Eutettix tenella*, Baker, in southern Idaho in 1930 was incorrect, partly because the chief swarms spread from breeding grounds in the north-western area [*cf.* *R.A.E.*, A, xix, 550 ; xx, 608] and not, as anticipated, from those in the south. The dispersal of the pest in various localities and the incidence of curly-top on beet and beans in 1930 are discussed in detail, and it is emphasised that future predictions of outbreaks should be based on the study of all possible breeding areas. The assumption that a severe drop in winter temperature results in a low leafhopper population was not justified in 1930, which indicates that such correlation [*cf.* xviii, 349] can be determined by long observations only. The early spring weather of 1930 was unusually hot and dry, which favoured early and rapid development of the leafhoppers as well as of the mustards [*cf.* xvi, 406] which are their first food-plants. It is, however, believed that a high winter survival of the pest was an important factor responsible for the outbreak in 1930.

Hallock (H. C.). **Life History and Control of the Asiatic Garden Beetle.**—*Circ. U.S. Dept. Agric.*, no. 246, 16 pp., 10 figs., 10 refs. Washington, D.C., December 1932. [Recd. July 1933.]

Fleming (W. E.) & Osburn (M. R.). **Control of Larvae of the Japanese and the Asiatic Beetles in Lawns and Golf Courses.**—*Circ. U.S. Dept. Agric.*, no. 238, 10 pp., 5 figs., 6 refs. Washington, D.C., August 1932. [Recd. July 1933.]

In the first paper an account is given of the bionomics of *Aserica* (*Autoserica*) *castanea*, Arrow (Asiatic garden beetle), a pest of lawns and various plants, a list of which is given [*cf.* *R.A.E.*, A, xxi, 236], and its control by means of lead arsenate [*cf.* xviii, 413], the application of which against this Melolonthid and also against *Popillia japonica*, Newm. (Japanese beetle) and *Anomala orientalis*, Waterh. (Asiatic beetle) on lawns and golf courses is dealt with in greater detail in the second one. It is stated that it is possible to maintain a good sward with populations of 100–150 larvae of *P. japonica* or *A. orientalis* or 150–200 of *Aserica castanea* per sq. yd., though at these proportions extensive damage may be caused where the growth of the grass is retarded by unfavourable conditions. Lead arsenate is most effective if applied to lawns in the process of construction before hatching occurs in July and August, and may be mixed with sand, soil or an organic fertiliser and distributed by a fertiliser spreader, two types of which are illustrated. No harmful effects have been observed from the use on treated turf of such fertilisers as well-rotted manure, ammonium sulphate, sodium nitrate, potassium chloride, superphosphate, bone meal and lime, though the application of the latter is only recommended where the acidity of the soil requires correction, and the inorganic types must be applied carefully to avoid superficial injury to the foliage [*cf.* xviii, 272].

The effectiveness of the treatment of established lawns depends on the presence of a poisoned layer at the surface of the soil, which may be obtained in one application or built up gradually, the first application being made before July in either case. The arsenical may be applied in water, sufficient to obtain uniform distribution without flooding the

turf ; satisfactory results have been obtained with power sprayers with a mixture of 1 lb. lead arsenate to 1–2 U.S. gals. water. The material should be washed off the grass before it dries. Lead arsenate in dry form, used in treating a comparatively small area, may be mixed with about 25 times its volume of moist sand, soil or other suitable material and broadcast by hand. Over large areas it may be applied in a distributor with activated sludge (1 : 4, by weight), activated sludge or tankage and sand (1 : 2 : 4) or sand alone (1 : 10). Injury resulted in some cases from the addition of inorganic fertilisers, and their incorporation in the mixture is not recommended at present.

It is considered that the application of lead arsenate will afford protection for 5–10 years.

NOBLE (W. B.). **Sod Webworms and their Control in Lawns and Golf Greens.**—*Circ. U.S. Dept. Agric.*, no. 248, 4 pp. Washington, D.C., November 1932. [Recd. July 1933.]

Unusually severe injury to lawns and golf courses was caused in the summer of 1931 in the United States by *Crambus* spp. [*cf. R.A.E.*, A, xxi, 285]. Their abundance was thought to be due to their gradual concentration in artificially watered areas of grass during the dry summers of 1930 and 1931, and to the unusually large numbers of larvae that survived the mild winters preceding them. Brief notes are given on the bionomics of these Pyralids and the injury caused by them. The eggs are laid among the grass stems and hatch in a week or 10 days, the young larvae feeding on the leaves and forming silken webs. When more mature, they form a tunnel into which they drag blades of grass which they cut off in order to feed on them. It has been estimated that each larva eats 7–13 linear feet of bluegrass [*Poa*] leaf or its equivalent. They afterwards pupate in a cocoon in the soil, the adults emerging 10–14 days later. Hibernation takes place in the larval stage in silken tunnels.

Natural enemies include a Braconid of the genus *Apanteles* and the Tachinids, *Phorocera claripennis*, Macq., and *Zenillia caesar*, Aldr. In a period of plentiful rainfall in the autumn of 1931, many larvae were killed by the fungus, *Beauveria bassiana*.

Good control was obtained with a commercial pyrethrum extract (1 oz. to 4 U.S. gals. water) applied to the turf at the rate of 1 U.S. gal. per sq. yd. The larvae came to the surface in a few minutes and eventually died. This treatment costs about 2*d*. per sq. yd., but is not poisonous to man and does not injure the grass. One part kerosene emulsion (consisting of 1 lb. laundry soap dissolved in 1 U.S. gal. boiling water to which ½ U.S. gal. kerosene is added, and thoroughly stirred or pumped) in 50 parts water applied at the same rate cost only 2*s*. for a plot 50 ft. square and was as effective as pyrethrum, but less convenient to prepare.

REED (W. D.), LIVINGSTONE (E.) & MORRILL, jr. (A. W.). **A Pest of cured Tobacco,** *Ephestia elutella* **Hübner.**—*Circ. U.S. Dept. Agric.*, no. 269, 16 pp., 7 figs., 12 refs. Washington, D.C., May 1933.

An account is given of laboratory investigations carried out during the summer and autumn of 1931 at Richmond, Virginia, on the biology of *Ephestia elutella*, Hb., which has recently appeared in the United States as a pest of bright, flue-cured tobacco [*R.A.E.*, A, xix, 215]. The stages are briefly described, and the damage this moth causes is

compared with that effected by *Lasioderma serricorne*, F. In observations on the offspring of moths collected in warehouses on 22nd June, the life-cycle from egg to adult of those hatching in June and July varied from 45 to 95 days and of those hatching in August from 56 to 81. The average longevity of the females was 8·7 days at mean average temperatures of 73·3–84·5°F., the pre-oviposition period averaging 0·7 days, the oviposition period 6·3 and the post-oviposition period 1·7. The total number of eggs laid by a single female ranged from 37 to 279, with an average of 127·3, 0–90 being laid during 24 hours and the greatest number being deposited within 5 days. Of 3,820 eggs the average maximum hatched in 7·1 days and the average minimum in 4·5. They were generally attached to the leaves and the larvae fed on the tender parts between the veins and the mid-rib, usually working from the stem towards the tip. The young larvae have difficulty in feeding on hard, dry material, and a low moisture content results in heavy mortality. They have been found feeding as deep as 8 ins. from the staves in hogsheads of tobacco and have sometimes inflicted serious damage on leaf material. Those hatching from eggs laid in June and July fed 29–72 days and those from eggs laid in August 35–54. The pupal period was passed in a silken cocoon in spaces between staves or near the surface of the hogsheads or in sheltered spots in the warehouses. During August–September it averaged 11·3 days and during October–November 16·7 days for 30 pupae. It is probable that four generations developed from 1st June to 31st October in unheated warehouses. Adults reared in the laboratory showed a ratio of 46·7 per cent. males to 53·3 per cent. females, and those collected from infested warehouses 60 per cent. males to 40 per cent. females.

During the summer of 1930 the larvae were parasitised by *Microbracon hebetor*, Say, the life-cycle from egg to adult of 30 of the parasites in October and November at 73–78°F. occupying 20–24 days, the egg period lasting 2–3, the larval 8–10 and the pupal 9–12.

Tobacco may be stored for 1–4 years or longer before manufacture, and in this period, under favourable conditions, *E. elutella* may develop in large numbers and cause serious injury. Examinations of infested hogsheads indicate that pollution from the webbing and excrement of the larvae often results in greater losses than the actual devouring of the leaf. Efforts should be made to locate infestations and prevent their spread, and infested material should be promptly fumigated, hydrocyanic acid gas having greatly reduced the moth in experiments in the warehouses.

Fleming (W. E.). **Contact Sprays for the Japanese Beetle.**—*Circ. U.S. Dept. Agric.*, no. 280, 4 pp. Washington, D.C., 1st June 1933.

Notes are given from the literature on the preparation and application of contact sprays of pyrethrum [*R.A.E.*, A, xv, 144 ; xvi, 82, etc.] against the Japanese beetle [*Popillia japonica*, Newm.]. The preferred formula is prepared by stirring 15·2 oz. sodium hydroxide C.P. dissolved in 2 U.S. qts. water into 5 lb. mixed fatty acids from coconut oil and 2 U.S. gals. water heated to approximately 160°F. and then removed from the fire. To the liquid, when clear, is added 9·5 oz. alcoholic extract of pyrethrum flowers and, when cool, 9 fl. oz. sodium silicate solution (40–42 Bé., composed approximately of 9 per cent. Na_2O, 29 per cent. SiO_2 and 62 per cent. water), the whole being diluted with 47·5 U.S. gals. water. Before spraying, the beetles may be concentrated on plants of no economic value by the application of an

attractant emulsion consisting of 10 gm. U.S.P. oleic acid and 4·5 gm. U.S.P. beta-naphthol dissolved in 60 cc. geraniol with the addition of 3 cc. sodium hydroxide solution (containing 0·5 gm. NaOH per cc.) and 4 cc. water, this stock emulsion being diluted at the rate of 1 pint to 1 gal. water.

Collins (C. W.) & Potts (S. F.). **Attractants for the flying Gipsy Moths as an Aid in locating new Infestations.**—*Tech. Bull. U.S. Dept. Agric.*, no. 336, 43 pp., 6 figs., 4 refs. Washington, D.C., December 1932. [Recd. July 1933.]

Details are given of investigations carried out intermittently since 1913 with baits containing an attractant secreted by unmated females of *Porthetria dispar*, L., used in place of living females in traps to detect new infestations [*R.A.E.*, A, xix, 493]. The male is a strong flier and locates the female, which does not fly, by means of scent. The males sometimes flew as far as 2·38 miles, but they were rarely trapped over half a mile from a colony. Methods of extracting the attractant, of which a detailed account is given, have already been noticed in brief [*loc. cit.*]. Tests showed that little can be extracted from newly-emerged females, but that the quantity increases rapidly for at least one day. Unmated females attract males as long as they live, but mated ones generally do not attract them, and the amount of the attractant that may be extracted decreases rapidly after mating.

The female abdominal tips should be removed at the age (two days after emergence) when they yield the greatest quantity of the attractive substance. Of the various solvents tested for their value in holding and releasing this, xylene and benzene gave the best results, benzene preserving it over a longer period. It has been preserved longer (7 years) in alcohol than in any other solvent, activity ceasing in most of them after the third year.

Rockwood (L. P.) & Reeher (M. M.). **The Hessian Fly in the Pacific Northwest.**—*Tech. Bull. U.S. Dept. Agric.*, no. 361, 23 pp., 2 figs., 25 refs. Washington, D.C., May 1933.

An account is given of investigations begun in 1916 on *Mayetiola* (*Phytophaga*) *destructor*, Say (hessian fly) in Oregon and Washington States, where it is found only in the humid area west of the Cascade Mountains. It is there of less importance as a pest of wheat than in many other areas, owing to the prevailing practice of late autumn sowing [*cf. R.A.E.*, A, xvii, 284 ; xx, 590, etc.] Its life-history and bionomics [*cf* viii, 376 ; xviii, 477, etc.] are dealt with, and the influence of climatic factors and various cultural control measures are discussed.

It causes some damage every year, which may be quite serious, especially to wheat sown in the winter and early spring. The greatest injury occurs when conditions are favourable to a large and early second spring emergence. At least three partial generations appear to occur normally, the adults usually emerging during the periods March to early May, late May to June or early July, and late August to early October. Small numbers occasionally emerge in July or early August and in late October. The principal sources of flies that emerge after overwintering in puparia are the stubble and self-sown wheat in fields of young clover. Barley and rye are sometimes infested also, and *Agropyron repens* [*cf.* xix, 494] may possibly be of some importance as an alternative food-plant of the autumn brood. In severe infestations,

where more than 50 per cent. of the culms are affected, the loss on fertile soil may amount to 6–8 bushels of grain per acre, but the average loss, even when the fly is abundant, is probably less than half as much

Parasitism of puparia collected in the field in 1918, 1919 and 1923 amounted to 34, 48 (over 75 per cent. of which was due to *Platygaster* spp.) and 44 per cent. respectively. *Platygaster hiemalis*, Forbes, is probably the most important parasite; it usually has two annual generations, the first appearing in May and parasitising the offspring of the last flies of the first spring emergence and those of the second spring emergence, and the second appearing in August and September and attacking the autumn brood. *P. herricki*, Pack., sometimes parasitises considerable numbers of the first brood, but it appears to be more susceptible to drought than the previous species or its host. Other important species attacking the puparia are the Pteromalid, *Merisus destructor*, Say, and *Eupelmus allyni*, French, though the Eulophid, *Pleurotropis epigonus*, Wlk., and *Eupteromalus* sp. are abundant in some years. The Pteromalid, *Amblymerus mayetiolae*, Gah., appears to be rare and of local distribution. *Eupelminus saltator*, Lind., *Eurytoma* sp., and the Eupelmid, *Calosota metallica*, Gah., are more commonly parasites of *Harmolita* sp., while *Eupelmus allyni*, which is also frequently reared from *Harmolita*, appears to be more common on *Mayetiola destructor*. Other parasites reared during the investigations were the Pteromalid, *Callitula bicolor*, Spin., *Eurytoma phoebus*, Gir., and *Tetrastichus carinatus*, Forbes. Some of these may be secondary as well as primary parasites, particularly *Eupteromalus*, of which there may be two species.

The general adoption of the most effective control measure, the ploughing in and burying of all wheat stubble in autumn, is prevented by the practice of sowing clover in wheat, and it is doubtful whether *M. destructor* alone is normally of sufficient importance to cause its abandonment. Wheat sown about the middle of October is usually least injured; that sown in September is infested by the autumn brood, and that sown in winter and early spring is the most liable to damage by the spring broods.

CHAPMAN (P. J.). **Viability of Eggs and Larvae of the Apple Maggot** (*Rhagoletis pomonella* **Walsh**) **at 32°F.**—*Tech. Bull. N.Y. St. Agric. Expt. Sta.*, no. 206, 19 pp., 3 figs., 26 refs. Geneva, N.Y., February 1933.

In view of the restrictions placed since 1930 on apples infested by *Rhagoletis pomonella*, Walsh, where the fruit is destined for foreign markets [*cf. R.A.E.*, A, xix, 492], experiments dealing with the effect of refrigeration on the apple maggot were conducted in New York in 1930–32. It was found that the eggs and larvae of *R. pomonella* are unable to survive continued exposure to temperatures customarily maintained in storage houses (31–33°F.), complete mortality being effected within 35 days when infested fruit is kept continuously at 32°F. The introduction of one or more warm periods in the storage schedule increased rather than lessened the resistance of the larvae, a similar effect having been observed in tests with *Ceratitis capitata*, Wied. [xiv, 127], against which refrigeration has also been used.

Emergence of larvae from apples starts about 15th–20th July and from late-ripening varieties may continue until December. Whereas in nature the great majority are exposed to mean temperatures ranging

between 55 and 70°F., evidence shows that those emerging late may endure considerably lower mean temperatures and may even survive in fruit when air temperatures below 32°F. occur for short periods. The natural rate of mortality in 20 varieties of apple was found to increase with the lateness of ripening of the fruit, and in some cases approached or attained 100 per cent. Temperatures in common storage houses vary considerably, but in most of them the temperature seldom averages below 40°F. during the earlier part of the storage period, and other investigators have shown that the larvae may emerge under common storage conditions.

The keeping quality of apples attacked by *R. pomonella* varies considerably, mainly with the variety and the amount and stage of infestation. Refrigeration stops the progress of larvae through the fruit and either suspends or greatly delays the decay produced by bacteria or fungi in the larval tunnels. The possibility of premature ripening or decay following disinfestation by refrigeration should be of no consequence in picked fruit of later varieties that showed an original infestation ranging up to 5 per cent.

The use of extremes of temperature in stored foods as an insecticidal measure against various Trypetids and weevils is discussed from the literature.

HARMAN (S. W.). **Codling Moth Control.**—*Bull. N.Y. St. Agric. Expt. Sta.*, no. 627, 31 pp., 3 figs., 3 refs. Geneva, N.Y., April 1933.

The abnormal abundance of *Cydia* (*Carpocapsa*) *pomonella*, L. (codling moth) on apples during the past 3 years, particularly in western New York [*cf. R.A.E.*, A, xxi, 331], is ascribed largely to the occurrence of unusually favourable conditions for its development and the omission of certain of the midsummer sprays owing to the need for economy, attempts to avoid injury from spray burn and fear of residue. In view of this situation, experiments were undertaken to determine the efficiency of the current spray practices. An account is given of the more important data collected chiefly in 1932 in a comprehensive series of experiments to determine the habits of the moth, with particular reference to the entrance of the larvae into the fruit and the influence of cover sprays in preventing " worm holes " and " stings."

The following is taken from the author's abstract and conclusions: During the past few years oviposition has occurred from early June until September, except for occasional short periods of inclement weather, the eggs hatching within 6–11 days. A reduction in the rate took place for a short period in late July and early August, marking an interval between the broods. It is pointed out that in the adaptation of control measures to individual requirements, the relative importance of the pest in different years, localities and orchards must be considered. The general principles, however, apply in every case, the correct timing of spray applications being of chief importance and supplementary practices such as cultural measures and banding also being of value. The omission of sprays against first-brood larvae in the latter part of June and in July was found to result in a considerable increase in the amount of injury to the fruit.

In general, the programme recommended for New York was very effective in controlling serious infestations. Four thorough and well-timed applications during June and July made later applications against the second brood unnecessary, though during certain seasons

in some localities one spray may prove desirable. In the treatment of the trees special attention should be given to the top and the interior, where coverage of the fruit and foliage is usually poor ; pruning to permit thorough spraying, and thinning to break the fruit clusters and to remove defective fruit are important considerations. In tests to determine the comparative efficiency of various brands of lead arsenate, little or no difference was observed in the degree of control at standard strength. The use of spreaders improved the appearance of the fruit, but did not apparently add to the toxicity of the sprays. Fish oil, linseed oil and mineral oils markedly increased the efficiency of lead arsenate when used in combination, especially with regard to stung fruit, but they have disadvantages in that they are incompatible with fungicides, retain residue on the fruit and cause injury to some varieties. Nicotine sulphate in combination with oil sprays proved an effective substitute for lead arsenate in the fourth cover spray.

The banding of trees is considered probably to be warranted only where spraying does not prove entirely satisfactory. Bands chemically treated with beta-naphthol and oil were the most practical and killed nearly all the larvae that spun cocoons beneath them. They should not be used on young trees with smooth bark, as they may cause injury. Fruit that was effectively protected against *C. pomonella* invariably retained spray residue in excess of the tolerated quantity (0·01 gr. As_2O_3 per lb. fruit). Mechanical dry cleaners were found to be most suitable for the removal of light or moderate residues below 0·02 gr. For heavier deposits, a hydrochloric acid solution used in apple-washing machines successfully cleaned the fruit to meet legal requirements.

The problem presented by the residue deposited by sprays of lead arsenate and other objectionable substances applied against *C. pomonella* and the apple maggot [*Rhagoletis pomonella*, Walsh] after mid-July is discussed.

PHILLIPS (E. F.). **Insects collected on Apple Blossoms in western New York.**—*J. Agric. Res.*, xlvi, no. 9, pp. 851–862, 1 ref. Washington, D.C., 1st May 1933.

Collections were made in the spring of 1931 in seven orchards in New York State along the shore of Lake Ontario of insects associated with the pollination of apple blossoms. The numbers captured were very small, a fact that cannot entirely be attributed to the sometimes unfavourable weather conditions. Lists are given of those found, chiefly flies and bees of the genera *Halictus*, *Andrena* and *Bombus*, with indications of the frequency of their occurrence, and in the case of the bees also with records of temperature and time of collection. Honey-bees [*Apis mellifica*, L.] were not intentionally collected, but they were estimated to outnumber all other insects combined by at least 3 to 1. The possibility of increasing the wild species is briefly discussed. Their scarcity is probably due to the gradual decrease of waste and wood land and the spread of cultivation, which reduces the nesting and hibernation places ; moreover, dusting destroys many honey-bees and probably also the solitary species. The numbers of the Syrphid, *Eristalis arbustorum*, L., which breeds in shallow polluted water, could perhaps be increased by providing suitable breeding-places.

SCHOENE (W. J.) & UNDERHILL (G. W.). **Economic Status of the Green Stinkbug with Reference to the Succession of its Wild Hosts.**—*J. Agric. Res.*, xlvi, no. 9, pp. 863–866, 1 fig., 5 refs. Washington, D.C., 1st May 1933.

Studies in Virginia during the past seven years on the bionomics of *Nezara* (*Acrosternum*) *hilaris*, Say, suggest that it can maintain itself in numbers only when a succession of wild food-plants is available. A list is given of some of these, with notes on their respective importance in the development of the bug. There is one yearly generation, the active breeding and development period lasting about three months; this is generally too extended for one host to furnish a continuous supply of food, which consists of the green pods or fruit. A preferred food-plant is elder (*Sambucus canadensis*), which provides food from mid-June to mid-August. Black locust (*Robinia pseudacacia*) and lime (*Tilia americana*) cease to provide food about the beginning of August. From these, especially in the absence of a later wild food-plant, such as honey-locust (*Gleditsia triacanthos*) or mimosa (*Acacia angustissima*), the nymphs migrate to neighbouring cultivated crops. Instances are quoted of such migration in Virginia to grapes and sweet peppers [*Capsicum*] and especially to lima beans [*Phaseolus lunatus*], on which the bugs are often associated with the fungus, *Nematospora phaseoli* [*R.A.E.*, A, xiv, 298, 299], which may result in a complete crop failure, especially in wet seasons.

Of the natural enemies in Virginia, the egg parasites were the most important, the commonest being *Trissolcus euschisti*, Ashm. [*cf.* v, 367], *Anastatus reduvii*, How., and *A. pearsalli*, Ashm., while *A. mirabilis*, Walsh, *Telenomus dimmocki*, Ashm., and *T. podisi*, Ashm., were scarce. In some localities the total egg parasitism reached 55 per cent. Nymphs and adults were sometimes parasitised by the Tachinid, *Trichopoda pennipes*, F.; in one collection the number of parasitised adults reached 65 per cent.

WHITCOMB (W. D.). **Control of Root Weevils on *Taxus* and other Nursery Plants.**—*Nat. Nurserym.*, xxxix, no. 11, pp. 5–6, 1 fig., 1931. (Abstract in *Expt. Sta. Rec.*, lxviii, no. 6, p. 793. Washington, D.C., June 1933.)

The larvae of the strawberry root weevil, *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., and the black vine weevil [*O. sulcatus*, F.], have been reported damaging the roots of Japanese yew (*Taxus cuspidata*) in New England nurseries. Occasionally 50 per cent. or more of the nursery plants have been infested as well as isolated trees in ornamental plantings. In addition to food-plants already recorded [*R.A.E.*, A, xv, 256; xviii, 455], *O. sulcatus* attacks *Retinospora*, *Rhododendron*, *Ampelopsis* and a variety of other plants. Soil treatment has proved unsatisfactory, but a commercial poisoned apple bait [xxi, 195] and one of 10 lb. raisins soaked in water for 2 hours, 1 lb. sodium fluosilicate or calcium arsenate and 10 lb. shorts or bran were effective. Bait should be applied when the adults emerge from the soil (approximately 15th June in Massachusetts), a small handful being placed near the trunk of each tree, and if they are numerous, a second application should be made 2 weeks later.

WEIGEL (C. A.) & SMITH (F. F.). **The Present Status of the *Gladiolus* Thrips in the United States.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 523–528, 1 ref. Geneva, N.Y., June 1933.

Taeniothrips gladioli, Moult & Stnw. (gladiolus thrips) has continued to be a serious pest in the United States during 1932 over a larger area than previously reported, having been particularly abundant and destructive in the eastern Atlantic States. The following additional species, which have evidently been confused in many cases with *T. gladioli*, have been collected on *Gladiolus* during the past season: *Aeolothrips fasciatus*, L.; *Chirothrips manicatus*, Hal.; *Frankliniella fusca*, Hinds; *F. tenuicornis*, Uzel (*nervosa*, Uzel); *F. occidentalis*, Perg.; *F. tritici*, Fitch; *F. tritici* var. *bispinosa*, Morgan; *Hercothrips* (*Heliothrips*) *femoralis*, Reut.; *Limothrips cerealium*, Hal.; *Sericothrips cingulatus*, Hinds, and *Thrips tabaci*, Lind. During the early part of the season *F. fusca* was very abundant and caused considerable confusion owing to the impossibility of distinguishing the damage done by it from that caused by *T. gladioli*.

Besides damaging the foliage and flowers, *T. gladioli*, by feeding on the stored corms, injures the corm surface, rootlets and shoots, resulting in a retardation of development when the crop is planted.

In addition to other food-plants already noticed [*R.A.E.*, A, xx, 420], this thrips has been reared on the foliage of Japanese iris and on the bulbs of Spanish iris.

From the studies hitherto conducted it appears that the thrips is taken into storage when the crop is harvested and breeds there until planting time when it is returned to the field. In cage tests and field observations *T. gladioli* failed to overwinter on other food-plants out of doors or in piles of *Gladiolus* tops or in corms in the soil. Further evidence of this was observed in seven cases in which a thrips-free crop was grown in 1932 in the same fields in which the 1931 crop had been severely infested or in adjacent fields. The predacious Anthocorid, *Orius insidiosus*, Say [xx, 421], while commonly present in the field, has failed to prevent serious flower injury.

Of the various corm treatments employed by commercial growers, complete control was obtained by immersion in semesan [hydroxymercurichlorophenol] solution (1 lb. to 50 U.S. gals. water for 17 hours or 1 lb. to 10 U.S. gals. for 7 hours) or by fumigation with naphthalene flakes, which is recommended as the most suitable method [xxi, 256, 319]. Fumigation with ethylene dichloride-carbon tetrachloride mixture [xxi, 230, 287] proved equally effective but caused severe injury in cases of overdosage or overexposure. Observations in several greenhouses show that *T. gladioli* is not controlled by spraying twice weekly with a strong solution of nicotine or pyrethrum extract or by the application of naphthalene flakes to the surface of the soil of the bed in which the plants are being forced.

SMITH (F. F.) & NELSON (R. H.). **Life-history Studies of the Gladiolus Thrips** (*Taeniothrips gladioli*, **M. & S.**).—*J. Econ. Ent.*, xxvi, no 3, pp. 528–536, 1 pl., 3 refs. Geneva, N.Y., June 1933.

Brief descriptions are given of the methods used in life-history studies of *Taeniothrips gladioli*, Moult. & Stnw., carried out during the 1931–32 storage season on dormant cormels, and on aerial growth in the insectary during the summer of 1932 at Washington, D.C., and also of the egg, the two larval and the two pupal stages of this thrips.

The following is the authors' summary: The studies showed that 50° and 90°F. represent the approximate extremes of temperature for development since no eggs hatched at either temperature, except a few at 90°F. and 100 per cent. relative humidity. Eggs in corms exposed for 7 days or longer to a temperature of 33°F. failed to hatch. Larvae and pupae which developed slowly at 50°F. required average periods of 27 and 19 days respectively for development. At 60°, 70° and 80° the insect developed normally, but at accelerated rates with each higher temperature, since incubation required average periods of 10, 6·3 and 3·6 days; larval development 11·3, 6·9 and 3·4 days; pupal stages 10·3, 6·1 and 3·7 days; and the total development 31, 19 and 10·6 days respectively.

Six generations, each requiring approximately 2 weeks, were reared in the insectary between 10th June and 6th September. Additional generations may develop out of doors during one season under conditions prevailing at Washington, and breeding may be continuous on *Gladiolus* foliage or corms at favourable temperatures. There is no evidence of seasonal hibernation. Adults lived as long as 76 days, but the average for both sexes ranged from 26 to 32 days in the insectary and 42 days at 70°F. in storage. A maximum of 204 eggs was laid by one female, but the averages were 117 and 130 respectively in storage and insectary. Mating normally takes place, and both sexes are represented among the offspring, but unmated females produce only males.

The habits of the larvae of feeding in the leaf sheaths instead of on the exposed surfaces seem to be due to a positive thigmotropism rather than to negative phototropism. Larvae are often quarrelsome and evidently thrust others with their mouth parts, and this habit may be correlated with the isolation of the insects in the pupal stage. This thrips is relatively inactive at 70° or below [*cf. R.A.E.*, A, xxi, 287], and migrates very little in the field at this temperature.

SMITH (F. F.) & RICHARDSON (H. H.). **Preliminary Report on the Control of the *Gladiolus* Thrips on Corms in Storage.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 536–545, 4 refs. Geneva, N.Y., June 1933.

Results are given of preliminary experiments with various corm treatments, including heat, fumigants, insecticidal and fungicidal dips, dusts and smudges, for the destruction of *Taeniothrips gladioli*, Moult. & Stnw., and the effect on the corms and succeeding growth. Of 19 materials or treatments tested in the laboratory for the control of thrips on unscaled *Gladiolus* corms in storage, 8 showed a high degree of efficiency without injuring the corms. In the case of calcium cyanide [*cf. R.A.E.*, A, xx, 702], which kills all stages except the eggs, 3 fumigations at 10-day intervals, using a dosage of 5 oz. to 1,000 cu. ft., are recommended. A 24-hour fumigation, using 14 lb. ethylene dichloride-carbon tetrachloride mixture [*cf.* xxi, 464] per 1,000 cubic feet, killed all stages of *T. gladioli*, and only one treatment was required. Treatments with vapour heat for 4 hours at a temperature of 110°F. to 116°F. killed the eggs as well as the other stages in small lots of corms. When larger lots are treated, a longer exposure is required. None of these treatments, however, prevents later reinfestation. The application of 1 oz. naphthalene flakes to 100 corms or an immersion for 1–7 hours in a 1–50 solution of semesan [hydroxymercurichlorophenol] gave

complete kill of the thrips, and since these materials function as slow-acting fumigants, the corms are protected from reinfestation for a longer time than with any of the other treatments.

Heat treatments and ethylene dichloride-carbon tetrachloride fumigation hastened the breaking of the dormancy of the corms when used as recommended by Dustan [xxi, 287]. Increasing the dosage of the latter to 56 pounds per 1,000 cu. ft. injured the corms. Treatment in mercury bichloride [xxi, 230] or in semesan delayed the starting of growth after planting, but the effects were not permanent. None of the treatments otherwise affected the resulting growth, flowering or corm production unless the corms had been visibly affected at planting time.

Richardson (H. H.) & Nelson (R. H.). **Field Control of the Gladiolus Thrips** (*Taeniothrips gladioli* **M. & S.**).—*J. Econ. Ent.*, xxvi, no. 3, pp. 546–554, 2 refs. Geneva, N.Y., June 1933.

The following is substantially the authors' abstract : Sprays consisting of 1 oz. Paris green (about half the quantity recommended by Dustan [*R.A.E.*, A, xxi, 287]) and 2 lb. brown sugar in 3 U.S. gals. water ; ½ U.S. pint nicotine solution (50 per cent.), 1 lb. tannic acid and 1 lb. ferric oxide-skim milk in 50 U.S. gals. water ; and a combination of lead arsenate, as well as three other sprays, were tested, each on 15 small plots, during the 1932 season in Maryland, eight applications being made at weekly intervals. Each small plot contained two red varieties of *Gladiolus* which had been uniformly infested with *Taeniothrips gladioli*, Moult. & Stnw. The Paris green and brown sugar spray was by far the most efficient, not only in controlling the thrips but also in reducing thrips injury to the flowers. Data on the number and size of the flowers, foliage development and number and size of corms harvested indicated that a spray consisting of 2 U.S. qts. pine tar oil, 6 fl. oz. 40 per cent. nicotine sulphate and 8 U.S. gals. water, as well as a nicotine sulphate-soap spray, especially the latter, had a distinctly injurious effect on the plants. Of the five other insecticides that were tested on a smaller scale in the same field, a spray consisting of 12 fl. oz. white oil, 1 fl. oz. nicotine sulphate and 8 U.S. gals. water was most effective, but this did not approach the Paris green and brown sugar spray in efficiency.

Fourteen insecticides, including all the above, were tested in another field for their effect on uninfested *Gladiolus*. Only a spray consisting of 5 U.S. pints soap (40 per cent. concentrate), 11 fl. oz. 40 per cent. nicotine sulphate and 50 U.S. gals. water had any injurious effect, as evidenced by flower and corm production. Preliminary experiments indicated that one or two applications of naphthalene, paradichlorobenzene, tobacco dust, carbon bisulphide emulsion, or ethylene dichloride emulsion, applied to the soil just after planting the corms, would not be effective for controlling the thrips. Naphthalene and paradichlorobenzene, especially the latter, greatly retarded the growth of the plants and evidently caused some reduction in the corm and flower production.

T. gladioli does not appear to move about much during the growing and early blooming season, but considerable numbers do migrate, apparently close to the ground, after the flowers are out. Muslin barriers 3 feet high erected between the treated plots were apparently effective during flowering time in reducing any slight movement of

thrips from one plot to another. Observations of the predator, *Orius insidiosus*, Say, indicated that it can kill as many as 30 thrips a day and that it might reduce thrips populations in small isolated plots.

HAMILTON (C. C.). **Greenhouse and Field Tests for the Control of the** *Gladiolus* **Thrips** (*Taeniothrips gladioli* **M. & S.**).—*J. Econ. Ent.*, xxvi, no. 3, pp. 555–565. Geneva, N.Y., June 1933.

The results are given of experimental work in the control of *Taeniothrips gladioli*, Moult. & Stnw., in New Jersey, carried out in the greenhouse in the winter and spring of 1932, and of some field tests conducted in the following summer. Preliminary (cultural) control measures consist in the destruction of waste corms, self-sown plants and other rubbish in and surrounding the field to eliminate possible hibernation quarters. The second stage of control consists in the destruction of the thrips in corms in storage. In the third stage, when measures are taken against the thrips on growing plants, pyrethrins or rotenone were found to be more effective in dusts, applied either dry or as wet sprays, than in liquid sprays. Materials that gave satisfactory control, when applied early and regularly, failed to control infestations where the thrips were abundant and severe injury was beginning. One of the most satisfactory dust materials consisted of 67·8 per cent. inert dust, 25 per cent. powdered, air-floated derris root (containing 4 per cent. rotenone) and 7·2 per cent. powdered soap, applied as a spray (1 lb. to 3 U.S. gals. water). From 3 to 5 times more foliage was covered with 1 lb. dust used as a wet spray and with better results than with the same amount of dry dust.

In a discussion on this paper and the four preceding ones, Weigel stated that an enquiry among a number of growers in New York State indicates that the most effective dose of naphthalene flakes is 1 oz. to 100 corms. The flakes should be scattered among the corms after they are sufficiently cured, not earlier than one month after they are brought in from the field but preferably before midwinter. The danger of giving a decided flavour to fruit, particularly apples, stored with corms fumigated with naphthalene, is pointed out.

GINSBURG (J. M.). **Compatibility of Oil Emulsion-Cresylic Acid Sprays with Fungicides.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 566–572, 4 refs. Geneva, N.Y., June 1933.

In continuation of experiments carried out in New Jersey in 1930–31 [*R.A.E.*, A, xx, 677], laboratory tests were conducted in 1932 with a view to improving the stability of oil emulsion-cresylic acid mixtures in combination with Bordeaux mixture or lime-sulphur. Freshly prepared Bordeaux (4–6–50) produced a stable mixture with oil emulsions containing 0·5 per cent. cresylic acid, but lime-sulphur proved to be incompatible, except when treated with powdered skim milk or similar colloids.

The Bordeaux spray was made by adding 8 lb. copper sulphate as soon as the water and agitator were started in the tank. When the tank was about two-thirds full and most of the copper sulphate dissolved, 12 lb. hydrated lime was sifted in, and subsequently, while the agitator continued to run, enough oil emulsion to make up 3 per cent. actual oil was mixed in. The cresylic acid was added last, and finally the rest of the water to make up 100 U.S. gals was run in. In mixing the lime-sulphur spray, the agitator was started when the tank was

about half full. About 3 lb. of powdered skim milk, first made into a thin paste with a small amount of water in a separate container, was added, followed by the concentrated lime-sulphur. When the mixture of skim milk and lime-sulphur became uniform, the oil emulsion and finally the colloidal cresylic acid were mixed in and the water allowed to fill up the tank to 100 U.S. gals.

Following these tests, field experiments, carried out on 5 blocks of apple trees with as many selected sprays showed that the addition of Bordeaux mixture or lime-sulphur to an oil-cresylic acid spray did not in any way affect its toxicity to the eggs of Aphids or red mite [*Paratetranychus pilosus*, C. & F.], and that such a combination is a practical and economical one in the control of Coccids, Aphids, red mite and fungi.

Carter (R. H.) & Newcomer (E. J.). **Arsenical Residues found on Apples in the Pacific Northwest throughout a Season of typical Spraying with Lead Arsenate.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 572–580, 5 figs., 4 refs. Geneva, N.Y., June 1933.

Methods of determining the relation between arsenical deposit and weight and surface area of apples and the constantly changing relationship of these two measures caused by the growth of the fruit are discussed. For the purposes of investigation the simplest method was used, that of determining the residue on entire apples and of calculating the surface area from weight by assuming that the apples are spheres and have uniform density. A formula for ascertaining the surface area was developed, based on the discovery that the apples under investigation displaced about 1·2 cc. per gm. when submerged in water. Samples of apples were selected before and after each spray and at harvest time and analysed for arsenical residue. The arsenical deposit was removed by the ordinary rapid solvent method and the arsenic determined by the Gutzeit method. The area was calculated by ascertaining the average weight of the apples in each sample. The quantity of arsenic was calculated in terms of grains of As_2O_3 per lb. of fruit, milligrams per apple and milligrams per square centimetre of surface. A fairly uniform coating of about 0·006 mg. per sq. cm. was found to have been maintained during the season by spraying about every ten days when growth was rapid, and every two weeks later on. This was increased to about 0·012 mg. by each of the various applications, resulting in an average coating of about 0·10 mg. The deposit per lb. of fruit is shown to be high early in the season when the fruit is small and to become less later. Surface density of deposit, however, fluctuates about a nearly constant figure. This difference is due to the fact that the weight increases more rapidly than the surface area. The percentage of the total accumulated residue at harvest time put on by each spray is indicated ; it is estimated that the first 4 cover sprays, which are those made against the first brood of the codling moth [*Cydia pomonella*, L.], put on only 40 per cent., and the first 3 not more than 20 per cent. Since, therefore, 60 per cent. of the spray residue on harvested fruit is due to the last two applications, substitutes for lead arsenate are evidently of much greater value in these than in the early sprays.

Under the conditions of the experiment it appears that spraying should be done about every 10 days during May and June, when the first brood of *C. pomonella* is active, in order to maintain a fairly heavy coating, as there is rapid loss on account of weathering and growth of apples.

MERRITT (J. M.), DIBBLE (C. B.) & ROBEY (O. E.). **A Method of rapidly applying Liquid Soil Insecticides.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 580–582, 3 refs. Geneva, N.Y., June 1933.

In the course of carrying out control measures against a soil-inhabiting pest in Michigan in 1932, miscible carbon bisulphide was pumped by means of an electric motor at a definite rate into the water supply, and the resulting emulsion was subsequently distributed over several hundred square feet simultaneously through an unsized canvas hose, 2½ inches in diameter. The flow from the pump was governed by a pressure relief valve and a metering valve, protected against clogging by a 60-mesh screen. When filled with water at 10 lb. pressure, 12½ U.S. gallons seep uniformly through the pores of the fabric per 100 feet of hose per minute. By this method it is possible to apply carbon bisulphide emulsion at the rate of 2½ U.S. gals. per sq. ft. to an area of 600 sq. ft. per hour of actual operation, using one 200-foot length of porous hose. At a soil temperature of 50–60°F., this requires 142·5 cc. of solution and 25 U.S. gals. water per minute. It is possible with the equipment described to increase the number of lines of hose and treat a larger area at a time without changing the proportions, and it is also possible to change the proportions to meet different requirements. The cost of application is lower than that of any hitherto used. Where the water supply is adequate, one man can handle 1,000 ft. of hose, treating the soil at the rate of 160 U.S. gals. per minute.

HARTZELL (A.). **A Visit to Pyrethrum Fields of Dalmatia.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 583–586, 2 pls., 1 map. Geneva, N.Y., June 1933.

The following is the author's abstract : An account is given of a visit made in August 1932 to Dalmatia, and the pyrethrum industry of that country is briefly described. Proposed measures to improve the quality of the product are reviewed.

ROARK (R. C.). **The chemical Relationship between certain insecticidal Species of fabaceous Plants.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 587–594, 38 refs. Geneva, N.Y., June 1933.

Certain insecticidal species of Leguminous plants, representing six genera, contain constituents that are closely related chemically. A chemical and botanical classification of these, drawn mainly from the literature, is given, and their distribution is discussed. Rotenone is found in species of the following genera : —*Cracca* (*Tephrosia*), *Deguelia* (*Derris*), *Lonchocarpus*, *Milletia*, *Mundulea*, and *Ormocarpum*. Deguelin (an isomer of rotenone) and tephrosin (a hydroxydeguelin) are found in *Cracca*, *Deguelia* and *Lonchocarpus*. Toxicarol is found in *Cracca* and *Deguelia*. Other constituents of minor insecticidal value are also found in these plants. The amount of rotenone and other insecticidal constituents varies greatly according to the species and maturity of the plant, the nature of the soil in which it is grown and other factors. The relative toxicity of rotenone, the structural formula of which is given, deguelin, tephrosin and toxicarol, as determined by the work of various investigators [*R.A.E.*, A, xix, 101 ; xx, 300 ; xxi, 272, etc.] is indicated. It is suggested that the numerous species contained in the genera in which rotenone and related compounds occur will be found to have insecticidal constituents. Rotenone has been recently

found in the following additional plants :—*Derris grandiflora*, *Lonchocarpus guatemalensis*, *Polygonum* sp., *Spatholobus roxburghi*, *Tephrosia candida*, and *T. cinerea*.

Section of Plant Quarantine and Inspection.—*J. Econ. Ent.*, xxvi, no. 3, pp. 595–667. Geneva, N.Y., June 1933.

This series of papers includes : The present Status of the Gipsy Moth [*Porthetria dispar*, L.], by A. F. Burgess (pp. 598–603) ; Experience in Enforcing compulsory Clean-up Regulations on Account of the European Corn Borer, by W. E. Britton (pp. 604–606), which summarises the methods and results of three seasons' work against *Pyrausta nubilalis*, Hb., in the two-generation area in Connecticut ; Application of Horse Sense to Plant Quarantine, by T. J. Headlee (pp. 606–609), which lays down basic principles for the regulation of domestic Federal and State quarantines ; Report of the Central States Plant Board by P. T. Ulman (p. 610) ; Report of the Western Plant Quarantine Board, by A. C. Fleury (pp. 610–612) ; and Vapour Heat Treatment for the Control of Bulb Pests and its Effect upon the Growth of Narcissus Bulbs, by F. J. Spruijt and F. S. Blanton (pp. 613–620), in which it is shown that among other bulb pests, larvae and pupae of *Eumerus* spp. can be controlled by exposure to vapour heat for 3 hours at a temperature of 110°F.

HENSILL (G. S.). **Larval Parasites of the Codling Moth in the Santa Clara Valley, California.**—*J. Econ. Ent.*, xxvi, no. 3, p. 603. Geneva, N.Y., June 1933.

The Tachinid, *Lixophaga variabilis*, Coq., and the Braconid, *Ascogaster carpocapsae*, Vier., have been reared from larvae of the codling moth [*Cydia pomonella*, L.] collected in the course of experimental work carried out during the past three years in the Santa Clara Valley, California, the latter parasite being recorded for the first time from this locality. Natural parasitism by *L. variabilis* was found to be as high as 5 per cent. in some collections, but that by *A. carpocapsae* was very low.

WHITE (R. P.). **The Insects and Diseases of Rhododendron and Azalea.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 631–640, 2 pls. Geneva, N.Y., June 1933.

This paper includes brief notes for the use of nursery inspectors on the type of injury caused by, and the control measures recommended against, the following insects : *Stephanitis rhododendri*, Horv., *Aspidiotus hederae*, Vall., *Rhabdopterus picipes*, Oliv., *Aegeria* (*Sesia*) *rhododendri*, Beut., *Otiorrhynchus* (*Brachyrrhinus*) *sulcatus*, F., and the Scolytid, *Corthylus punctatissimus*, Zimm., on *Rhododendron* spp. ; *Stephanitis pyrioides*, Scott, *Gracilaria azaleella*, Brants, *Eriococcus azaleae*, Comst., and *Tetranychus telarius*, L., on *Azalea* spp. ; and *Popillia japonica*, Newm., *Aserica* (*Autoserica*) *castanea*, Arrow, *Anomala* (*Phyllopertha*) *orientalis*, Waterh., the Lamiid, *Oberea myops*, Hald., and thrips on both *Rhododendron* and *Azalea*.

Poos (F. W.) & Deemer (R. B.). **Is the Absorption of Copper by certain Crop Plants influenced by Climatic, Soil and other Factors?**—*J. Econ. Ent.*, xxvi, no. 3, p. 648. Geneva, N.Y., June 1933.

Preliminary tests carried out in Virginia in September 1932 in connection with the use of Bordeaux mixture (4–4–50) as a spray for the control of *Empoasca fabae*, Harr., on ground-nuts to determine whether this plant absorbs copper through the foliage, thereby killing the leaf-hoppers, as reported of beans and potatoes in Ohio [*R.A.E.*, A, xviii, 483], indicate that, under certain conditions of climate and soil, copper from Bordeaux mixture may not be absorbed by the plant.

Bigger (J. H.). **Parasites of the Sunflower Weevil,** *Desmoris fulvus* **Lec., during 1931 and 1932.**—*J. Econ. Ent.*, xxvi, no. 3, p. 652. Geneva, N.Y., June 1933.

Examination during the seasons of 1931 and 1932 of sunflower seeds to determine infestation by *Desmoris fulvus*, Lec., revealed the presence of the following parasites: *Microbracon mellitor*, Say, which was responsible for most of the parasitism found in both years, and *Eupelmus cyaniceps* var. *amicus*, Gir., in 1931 and the Pteromalid, *Trimeromicrus maculatus*, Gah., in 1932, neither of which had been previously recorded as parasitising this weevil. Of 80 parasites of the weevil reared since 1928, 75 were found to be *M. mellitor*, but the greatest rate of parasitism, which occurred in 1929, was only 6·2 per cent. and the economic value of this parasite is questionable.

Section of Extension.—*J. Econ. Ent.*, xxvi, no. 3, pp. 668–696. Geneva, N.Y., June 1933.

The first paper in this section, The Role of the Extension Service in combating Grasshoppers, by A. D. Worthington and A. M. Pearson (pp. 668–672, 8 refs.), describes briefly the methods used in organising the grasshopper control campaign in Iowa in 1931 and 1932. The recent outbreak was largely the result of an over-abundance of *Melanoplus differentialis*, Thomas, and *M. bivittatus*, Say, though *M. femur-rubrum*, DeG., and *M. mexicanus*, Sauss., also did considerable damage. Commercially prepared poison bran bait was used almost exclusively in the control work. The farmers were stimulated by field demonstrations to take early and proper control steps to ensure that a large proportion of the grasshoppers were poisoned in their hatching grounds. In consequence grasshopper damage did not exceed 10 per cent. of the crop in any field.

Other papers in this section include: Vegetable Insect Scouting in New Jersey, by R. C. Burdette (pp. 672–674), which discusses the systematic inspection of vegetable crops with the object of forestalling insect outbreaks; Spray Service for Vegetable Crops, by L. H. Shropshire (pp. 675–676), which gives an account of the activities carried on by this Service in Chicago, including scouting to forecast outbreaks, dissemination of control information and aid in securing dependable insecticides; Notes on Extension Work at the Virginia Truck Experiment Station, by H. G. Walker (pp. 677–680); Entomology in 4-H Club Works—at Camps, by G. D. Jones (pp. 680–682); 4-H Club Work and Entomology, by C. O. Hopkins (pp. 683–686); A Course in Insecticides for Pharmacists, by J. J. Davis (pp. 687–689); Directory of Manufacturers of Insecticides, their Products and Analyses, by T. J. Headlee (pp. 689–691); Insect Pests, by J. A. Hyslop (pp. 692–694),

in which the insect conditions of 1932 are discussed in relation to the effect of the weather, particularly of the preceding mild winter; and The Advantages of concentrating State Entomological Work, with special Reference to the regulatory and extension Phases, by C. Lyle (pp. 695–696).

CRESSMAN (A. W.). **Biology and Control of** *Chrysomphalus dictyospermi* **(Morg.)**.—*J. Econ. Ent.*, xxvi, no. 3, pp. 696–706, 1 fig., 12 refs. Geneva, N.Y., June 1933.

In view of the gradual increase of *Chrysomphalus dictyospermi*, Morg., in the New Orleans district and the consequent menace to avocados in Florida and California, studies of the biology and control of this scale have been made in New Orleans since 1923. Differences in the appearance of the covering such as those on which a number of varieties previously described have been based, were observed in single infestations with no corresponding morphological and biological differences in the scale, and it is suggested that such variations are of doubtful validity as criteria of varietal differences. It is possible, however, that in some strains of *C. dictyospermi* the females require fertilisation before reproduction instead of showing facultative parthenogenesis.

In the course of the experiments, which were carried out in a partly closed insectary, the eggs were deposited and hatched beneath the scale covering. A variation of 1–24 hours in the incubation period during midsummer indicated that they were deposited at various stages of development. The emergence of the larvae from beneath the parent scale showed a marked diurnal periodicity, the maximum occurring between 8 and 9 a.m. The rate of development was found to be largely dependent upon temperature. The effect of thermal change was most marked in the lower range, the acceleration decreasing at higher temperatures. In every case the first larval instar was shorter than the second at equivalent temperatures. No difference in the lengths of the instars was found on four different food-plants, but data on survival and productivity indicated that susceptibility of plants to the scale would be in the following order: *Citrus nobilis* (Satsuma orange), *Cycas revoluta*, *Latania commersoni*, *Cinnamomum camphora* (camphor). More males than females were produced, and fertilisation was necessary for reproduction. In the insectary 5–6 broods were produced in a year, but in the field all stages are present throughout the year and distinct broods cannot be distinguished.

C. dictyospermi is attacked by the following parasites: *Aphelinus chrysomphali*, Merc., *Prospaltella aurantii*, How., *Signiphora merceti*, Malen., and *S. flavopalliata*, Ashm., but they are none of them effective, as a number of young are produced before the scale is killed. More effective, but not generally distributed, are the Coccinellids, *Rhizobius debilis*, Blackb., and *Lindorus lophanthae*, Blaisd., which attack all stages. Spraying with oil emulsions, with oils of widely different character, containing 1–1·3 per cent. of oil, effected 100 per cent. mortality of the scale.

FAURE (Jacobus C.). **The Phases of the Rocky Mountain Locust** *Melanoplus mexicanus* **(Saussure)**.—*J. Econ. Ent.*, xxvi, no. 3, pp. 706–718, 1 pl., 4 refs. Geneva, N.Y., June 1933.

It has recently been suggested that *Melanoplus spretus*, Walsh, now apparently extinct, is the long-winged migratory phase of *Melanoplus mexicanus*, Sauss. (*atlanis*, Riley) [*R.A.E.*, A, xviii, 624]. An attempt

was therefore made, by adopting the experimental methods used with *Locustana pardalina*, Wlk., in South Africa [xx, 671], to transform *M. mexicanus*, which was surmised to be the solitary phase, into *M. spretus*.

The following is taken from the author's conclusions : The rearing experiments are described in detail. The observations and experiments warrant the conclusion that the form considered by the United States Entomological Commission as a distinct species and long known as *M. spretus* is the phase *gregaria* of *M. mexicanus*. The name *spretus*, Walsh, is therefore a synonym of *mexicanus*, Sauss.

This conclusion is based on the following facts : in the rearing experiments the type of nymphal coloration originally described as typical of *spretus* appeared only in cages containing crowds, whereas the nymphs reared in isolation acquired types of coloration similar to that described for *mexicanus* ; adults of *M. mexicanus* taken in Minnesota in June 1932 under outbreak conditions showed a strong tendency to vary in the direction of *M. spretus* in relative wing-length and size ; there is a close similarity between the relationships of *M. spretus* to *M. mexicanus* and those obtaining between the *gregaria* and *solitaria* phases in the African species of locusts.

In view of the small amount of material available for the present experiments and the fact that the observations covered one nymphal development only, further comparative studies should be undertaken with large series of *mexicanus* reared under conditions of crowding and of isolation.

Fragmentary observations made in Minnesota in 1932 suggest that the nymphs of *M. differentialis*, Thomas, may show a tendency to develop a type of coloration similar to that of the phase *gregaria* of true locusts when reared under conditions of crowding. It is also suggested that a study of the effects of crowding and isolation upon the nymphs of *Schistocerca americana*, Drury, may prove this to be the solitary phase of *S. paranensis*, Burm., the migratory locust of South and Central America.

PARKER (W. B.). **Vapo Dust—a Development in scientific Pest Control.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 718–720, 2 pls. Geneva, N.Y., June 1933.

A process is described whereby phytonomic oils, alone or containing concentrated insecticidal materials, are diluted with air to form a fog that envelops pest-infested plants or trees in such a manner as to cover them rapidly, economically and completely with a thin and uniform film of very active material. A phytonomic oil may be defined as one that can be safely applied to plant foliage without causing injury. More specifically, it refers to lubricating type oils from which unsaturated hydrocarbons, sulphur, the more sensitive cyclic hydrocarbons, acids having organic nuclei, and more volatile bodies and other chemically active bodies that would cause injury to foliage have been removed. This method eliminates the necessity of hauling large quantities of water and saves consequent loss of time in refilling the tank. It also puts the oil on in the most effective manner ; the insect, being dry, is immediately drenched with the oil, and there is no interference from the water phase of the ordinary spray application.

Experiments in controlling a very serious infestation of *Erythroneura comes*, Say, on grape vines in the San Joaquin Valley, California, in 1931, showed that small quantities of phytonomic oils, particularly when combined with a small amount of pyrethrum or nicotine, were

very effective against both nymphs and adults without causing injury to the vines. A machine was invented to apply this process commercially, which not only atomises the spray but dilutes it with air and drives it upon the plants and pests. It can be regulated to break a given amount of the concentrated insecticide into particles of the right size and dilute them in a constant volume of air. By moving the machine at a regular speed (3–8 miles an hour) a definite amount of material can be evenly and rapidly applied. As little as 2½ U.S. gals. per acre, applied in 6–10 minutes, was found to be effective.

Treatment by this process of the breeding-grounds of *Eutettix tenella*, Baker, in the San Joaquin Valley resulted in an estimated reduction of 90 per cent. in the leafhopper population and a great saving of sugar-beet in 1932. It has also been used effectively against brown apricot scale [*Lecanium corni*, Bch.], red spider and thrips on prunes ; thrips on onions ; and Aphids, thrips and leaf-miners on field peas. Arsenicals, fluorine compounds, nicotine, pyrethrum and other materials will be used with it later against leaf-eating insects.

GRISWOLD (G. H.). **Fish Meal as a Food for Clothes Moths.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 720–722. Geneva, N.Y., June 1933.

Where large numbers of *Tineola bisselliella*, Humm., are used for testing various methods of control, it is often difficult to maintain a large supply. An efficient method has been devised for rearing the moths with fish meal as the sole food supply. Moths reared on this material went through their life-cycles in an average of about 51 days, as compared with the normal life-cycle of 4–5 months, which may even be prolonged for a year. Cylindrical cardboard cartons with a capacity of 1 U.S. gallon are used as rearing cages. In the centre of a large square of cloth is pasted a large disk of heavy cardboard, slightly smaller than the bottom of the carton, and a layer of fish meal about ½ inch thick is spread evenly over it. The cloth is placed in the carton so that the cardboard rests on the bottom and is then folded back against the sides, the cover being afterwards replaced. Adults are admitted through a small opening in the cover, which is then closed with a piece of cheesecloth secured by a little paste. At living-room temperatures, adults will begin to emerge within about 2 months after a container has been infested. A supply of larvae can be obtained by opening the carton and lifting out the square of cloth, from which they can be removed by means of a camel hair brush. Eggs can be secured by catching a few adults and placing them in a vial with a piece of dark flannel.

It seems probable that colonies of *T. bisselliella* would maintain themselves for a considerable period if fresh fish meal were added from time to time.

MOORE (W.). **A new Development in the Fixation of Nicotine.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 723–726, 1 ref. Geneva, N.Y., June 1933.

The following is taken from the author's abstract : Nicotine tannate and lead arsenate as cover sprays for *Cydia pomonella*, L., have been compared to the advantage of the former [*R.A.E.*, A, xx, 515]. Its efficiency, however, is greatly reduced by the rapid disappearance of nicotine from the fruit and foliage sprayed with it. Attempts to prevent the dissolving away of nicotine tannate by the use of sticking and

coating materials have hitherto resulted in failure, only fish-oil giving encouraging results.

A new insoluble nicotine insecticide has now been prepared by heating an aqueous solution of nicotine, resorcinol and formaldehyde. A finely divided precipitate is obtained. The washed, air-dried product contains about 22 per cent. nicotine, which dissolves in water to the extent of 0·004 gm. in 100 cc., as against 0·015–0·02 gm. of the nicotine in nicotine tannate. Prepared as a paste, the new material was mixed with oil and applied to apples by dipping. Its toxicity to *C. pomonella* was equal to that of nicotine tannate, and the deposit left by it was about twice as resistant to washing with water.

WEBER (A. L.) & MCLEAN (H. C.). **The Removal of Lead and Arsenic Spray Residues from Apples.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 727–730, 3 refs. Geneva, N.Y., June 1933.

Although successful methods for the removal of arsenic from apples have been in use for some time, no work has hitherto been done on the removal of lead, the tolerance for which has recently been fixed at 0·014 gr. Pb per lb. of fruit. As the lead and arsenic are applied to the fruit in the form of acid lead arsenate, which contains 2·76 parts of lead (Pb) to 1 part of arsenic (As), the practical effect of meeting the lead tolerance will be to lower greatly the arsenical residue. The ratio of Pb, however, to As_2O_3, in which the arsenic tolerance (0·01 gr.) is expressed, is somewhat lower (2·09 to 1). Experiments have been carried out with a view to finding a method that would remove the excess of lead as well as arsenic from apples known to be difficult to wash. From the results obtained it may be concluded that the new lead tolerance can be met by immersion for 2·5 minutes at 70°F. in hydrochloric acid (1·5 per cent.) alone where no late oil sprays have been used and the fruit is not heavily coated with wax, with the addition of Vatsol (1 per cent.) or Alkanol B (5 per cent.) where late oil sprays have been used, and at 100°F. in 1 per cent. acid with 5 per cent. Vatsol where the fruit is heavily coated with wax and the deposit may or may not include oil spray residues. Alkaline washes (10 per cent. B.W. brand silicate) at 110°F. did not remove lead satisfactorily from the apples used in this experiment. The use of wetting agents with acid gives the fruit a clean and attractive appearance, whereas alkaline washes leave it with a dull, cloudy finish.

KNOWLTON (G. F.). **Length of Adult Life of *Paratrioza cockerelli* (Sulc).** —*J. Econ. Ent.*, xxvi, no. 3, p. 730. Geneva, N.Y., June 1933.

Data based on a limited number of cage tests are given on the longevity of adults of *Paratrioza cockerelli*, Sulc, in Utah on 21 plant species upon which the nymphs have not been found to develop. The number of days of survival noted varies from 17 on honeysuckle to 96 on Douglas fir [*Pseudotsuga taxifolia*], and the adults probably survive much longer under favourable conditions. The ability to survive on these plants doubtless helps to keep the adults alive from the time that potatoes and other breeding plants mature or are killed by frost until the winter hibernation period, and again in spring until breeding plants become available. The majority of the breeding plants hitherto observed in Utah, most of which are Solanaceous, are not available in early spring or late autumn.

SMITH (R. H.). **Lime-Sulfur Injury accentuated by Casein Spreader.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 730–731. Geneva, N.Y., June 1933.

In view of the accentuation of injury to fruit and leaves, particularly in pear orchards, caused apparently by the addition of casein spreader to lime-sulphur and lead arsenate sprays [*cf. R.A.E.*, A, xii, 276] in commercial tests carried out in various parts of the United States in 1922 and 1923, subsequent observations of similar injury are recorded. Scorching observed in a pear orchard in southern Oregon in 1925 was no more pronounced in plots where the spreader was used in combination with lead arsenate and lime-sulphur than where it was used with lime-sulphur alone. Severe injury to twigs was observed in an apricot orchard in California sprayed with lime-sulphur and caseinate spreader in the late winter of 1926. On plum trees in California sprayed in the early summer of 1932 with lime-sulphur with and without caseinate spreader, the crop was a total loss where the spreader was used, whereas injury was much less pronounced in the remainder of the orchard.

In the three groves cited the severe injury was sharply delimited to the rows where the spreader was used. Before 1926, casein spreaders consisted of approximately 80 per cent. hydrated lime and 20 per cent. casein. In recent years some spreaders have been composed of casein, soy bean flour and hydrated lime, and this type was used in spraying the plum orchard in 1932.

HERRICK (G. W.). *Otiorrhynchus ligustici* **L., a European Snout Beetle new to this Country.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 731–732. Geneva, N.Y., June 1933.

Weevils collected in April 1933 from newly planted raspberries in New York State were identified as *Otiorrhynchus ligustici*, L., which has not previously been recorded from North America. Further examination of the vicinity in which the beetles were first found showed their presence among grass and weeds where they had probably emerged from the soil. A brief description of this weevil is quoted.

BROWER (A. E.). **Control of the Birch Leaf-mining Sawfly.**—*J. Econ. Ent.*, xxvi, no. 3, p. 732. Geneva, N.Y., June 1933.

Four years of work in the control of *Phyllotoma nemorata*, Fall., which has been seriously injuring birch foliage over a large part of Maine since 1927 [*R.A.E.*, A, xvii, 553; xx, 526], has shown that 100 per cent. mortality can be obtained by the application of nicotine sulphate (1 : 800) with soap or penetrol. In experimental work in the field, a dilution of 1 : 1,000 killed 99–100 per cent. and one of 1 : 1,500 98–100 per cent., but these weaker dilutions have not been tested with power outfits on large trees. The time of application is very important, as the larvae become highly resistant after the second instar. The egg-stage is 19 days, and the eggs are killed by the spray, which should be applied when the mines reach a diameter of $\frac{1}{4}$–$\frac{3}{8}$ inch or between 20th and 30th July in central Maine. An application at this date, or slightly later, has given satisfactory control of both *P. nemorata* and *Bucculatrix canadensisella*, Chamb. Preliminary work indicates that Bordeaux mixture (3–3–50) applied in central Maine between 12th and 20th June and again 12 days later will give fair protection.

Snapp (O. I.) & Thomson (J. R.). **The Effect of Low Temperature on the San José Scale in Georgia.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 732–733. Geneva, N.Y., June 1933.

Data obtained in Georgia in 1933 show a reduction of from 92 to 57·2 in the percentage of living scales [*Aspidiotus perniciosus*, Comst.] in an unsprayed peach orchard between 4th February and 17th March, following a minimum temperature (on 9th February) of 11·9°F. Observations in two unsprayed orchards six miles apart on 25th April 1932, following a minimum temperature (on 10th March) of 18°F., showed 54 and 59 per cent. living scales, as against 85·5 and 92 per cent. on 23rd February. There was a larger percentage of young scales on the trees when the frost occurred in 1932 without a preceding period of cold weather, whereas, in 1933, cold weather before the frost had retarded reproduction. The difference in the reduction of scales during the two years may be accounted for by the fact that young scales are more susceptible to low temperatures than half-grown ones. The data indicate that unusually low temperatures in southern latitudes do not kill the majority of the scales on peach trees.

Rust (H. J.). **Many Bark Beetles destroyed by predacious Mite.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 733–734. Geneva, N.Y., June 1933.

Observations of the activities of mites in association with *Ips oregoni*, Eichh., on *Pinus ponderosa* are recorded. An examination of 9 sq. ft. of pine bark showed a range of 138–2,265 mites to the sq. ft., and they were seen to feed voraciously on the eggs of *I. oregoni*. By counting the number of normal eggs of *I. oregoni* and the number on which the mites were feeding, it was found that mortality varying from 52 per cent. in the first generation of the beetles to 85 per cent. in the fifth, with 10–25 per cent. in the intervening generations was caused by the mites. Mites have also been recorded [*cf. R.A.E.*, A, vi, 263] as feeding on the eggs of *Dendroctonus pseudotsugae*, Hopk., in Douglas fir [*Pseudotsuga taxifolia*], and are probably the chief cause of the 62·5 per cent. egg mortality observed for this species. Not all of the 4 species of mites observed in infested pine bark are predacious. Those destroying most eggs belong to the genus *Gamasus* (*Parasitus*). Being apterous, they are dependent on their host for transportation from old brood trees to those newly attacked, and they attach themselves to the adult beetles just before they emerge. On *Ips* they are found clinging to the concave declivity and beneath the wing covers, whereas on *Dendroctonus*, which have convex declivity, they are found under the abdomen and beneath the wing covers. As many as 42 mature and immature mites were found clinging to one adult of *I. oregoni*. Owing to this means of transportation, they arrive at the newly-attacked trees with the host and therefore start to feed as soon as oviposition begins. As soon as the egg-shell has been consumed, the mite begins to oviposit, the eggs being laid in groups that may contain as many as 60. They hatch in a few days, and the young mites scatter beneath the bark in search of food.

Essig (E. O.). ***Ptinus tectus* Boieldieu.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 734–735. Geneva, N.Y., June 1933.

Ptinus tectus, Boield., is recorded, apparently for the first time, from California, where it was found in large numbers on 30th September

1932 in stocks of fish meal. A list is given from the literature of the more important records of the occurrence of this beetle in various European countries.

Dawsey (L. H.). **A Laboratory Method for determining approximately the Evaporation of Petroleum Oil Sprays under Field Conditions.**—*J. Econ. Ent.*, xxvi, no. 3, pp. 735–736. Geneva, N.Y., June 1933.

Tests made at the laboratory of the Bureau of Chemistry and Soils, New Orleans, Louisiana, on oils for oil emulsions to be used against scale insects showed that whereas pure oils conformed to the manufacturers' specification with regard to Saybolt viscosity and unsulphonatable residue, discrepancies appeared in regard to the volatilities owing to the fact that the manufacturers used a different method for determining them. The technique employed in the method used by the Bureau of Chemistry and Soils and that used by the petroleum industry and known as A.S.T.M. D6–27 are therefore discussed, and references are made to various other methods. That employed by the Bureau requires a temperature of 110°C. [262°F.], whereas that used in the industry involves one of 163°C. [389·4°F.]. Most methods of determining volatility are devised primarily to ascertain the qualities of an oil when used as a lubricant in steam and internal combustion engines. Conditions are entirely different when the oil is to be applied in emulsified form to plants in the control of scale insects. It then spreads in a thin film over wide areas, and evaporation occurs gradually at ordinary out-door temperatures.

A procedure approximately reproducing the conditions of evaporation occurring on plant surfaces, based on a method devised by W. W. Scott for estimating the evaporation of spindle oils, has now been tentatively adopted by the Bureau. A ring-shaped disk of filter paper ($1\frac{5}{8}$ inches outside diameter with a centre hole of $\frac{5}{8}$ inch diameter), which has been previously dried for several days in an electric oven at 100°F., is placed upon a plain glass 2 inches square and weighed to one decimal place of a milligram, and about 0·2 gram of oil is dropped on it from a small pipette. The glass, paper and oil are then accurately weighed. After exposure in an oven to a constant temperature of 100°F. for 24 hours, they are re-weighed, and the percentage of loss due to evaporation is recorded. Variations in the porosity of the paper used may affect the rate of evaporation, but this can be obviated by the use of standard paper. Data given to show the volatility of 11 blends of oil determined by the method of the Bureau of Chemistry and Soils and the method proposed, and of two of the oils determined by the A.S.T.M. D6–27 method, indicate that volatility is an arbitrary term depending upon the method of determination. For all spray oils tested that were of specifications acceptable to manufacturers and growers, the evaporation rates range from about 1 to 2 per cent. For oils coming strictly within the lubricating class, the volatility factor for spray work is relatively unimportant, provided that not more than this percentage evaporates during the test.

Dustan (A. G.). **The Gladiolus Thrips.**—*Pamph. Dept. Agric. Canada*, no. 151 (N. S.), 12 pp., 7 figs. Ottawa, March 1933. [Recd. July 1933.]

The growing of *Gladiolus* is seriously threatened by *Taeniothrips gladioli*, Moult. & Stnw., which is now found throughout Canada, with

the exception of British Columbia, and is rapidly becoming distributed in new areas. Much of the information obtained in investigations on its bionomics and control in the Ottawa district has already been noticed [*R.A.E.*, A, xxi, 287]. *Gladiolus* appears to be the only true food-plant, though rearing was accomplished in the laboratory on *Iris*, *Canna* and carnation. All stages are described, and the injury caused is discussed [xx, 420 ; xxi, 464, etc.]. In the laboratory during the summer of 1932, the life-cycle from egg to adult generally averaged 14 days, the egg stage occupying 4–5, the larval 5–7, the pupal 4–5 and the pre-oviposition 1–2. There are probably 6 generations in the field, as 5 were reared between the third week of June, when the thrips were first found in the field, and the middle of September. A certain number continue to develop throughout the winter on stored corms and are carried with them into the fields in spring. Investigations showed that none survived the winter of 1931–32 out of doors, though fully 90 per cent. of the adults leave the beds in autumn and seek shelter elsewhere.

In view of the continuous migration of the thrips throughout the growing season and their ability to fly considerable distances (at least 200 ft. on a calm day), there is a great danger of infestation spreading from neighbouring beds.

Corms may be treated for the control of thrips in the spring, preferably just before planting if the temperature in the store is cool, or otherwise in the late autumn, having been left to ripen for one month. Several methods will effect complete mortality without injuring the corms but the following are recommended for commercial work : fumigation with naphthalene [xxi, 319 ; etc.] for 3–4 weeks at room temperatures ; immersion of corms, stripped of the husks, for 3 hours at 70°F. in mercury bichloride (1 oz. to 6 gals. water) followed by immediate planting without drying ; or immersion for 10 mins. in hot water at 120°F. just before planting [*cf.* xx, 421]. For control on the growing plants, many different dusts and sprays have been tested, of which the most successful is the Paris green and brown sugar spray previously recommended [xxi, 287, *cf.* also 466], which should be applied in the spring when the plants are 5–6 ins. high and at weekly intervals until the flowers begin to open. The slight browning of the lower leaves that results may be partly counteracted by the occasional application of cold water. In addition to other measures the tops should be cut at harvest as near the corm as possible and burnt or buried, and the topped corms should be allowed to dry away from the field in a situation inaccessible to *T. gladioli*.

KING (K. M.) & GLEN (R.). **A Co-operative Investigation of the Quantitative Relation between Summer-fallow Methods and the Wireworm in Saskatchewan. A Progress Report.**—*Sci. Agric.*, xiii, no. 10, pp. 646–652, 2 refs. Ottawa, June 1933.

In view of the fact that wireworms almost invariably cause damage to crops sown after a summer fallow season [*R.A.E.*, A, xvi, 509], experiments were carried out in 1930–32 on a field scale in Saskatchewan to test the effect of four different methods of summer fallowing on wireworm populations and on the amount of damage caused to wheat crops. Preliminary results showed that on infested soil wheat should be sown when conditions are most favourable to germination and rapid early growth. In 1931 when conditions were adverse, 65 per cent. of the wheat was destroyed by 2nd June, before it appeared above ground,

whereas in 1932 under excellent conditions, 3·3 per cent. was the heaviest damage recorded. Sufficient moisture at the time of sowing is the most important factor and can be secured by delaying if necessary the early sowing that is desirable in infested fields. Surface cultivation involving only shallow tillage, and the preservation of a firm subsurface is the most promising fallow method ; plots treated in this way in 1931 yielded over 3 bushels per acre more in 1932 than corresponding ones treated by any other method, whereas plots deeply and excessively tilled were the most seriously damaged and produced approximately 5 bushels less per acre. Wireworm damage retards the growth of the crop, thus allowing the weeds to develop to such an extent that they consume the available moisture which would have been utilised by the wheat plants. Local differences in the degree of infestation tend to persist, owing probably to soil variation or merely to the long life-cycle of the wireworms, which tends to perpetuate any difference accidentally established.

An account is given of the method by which soil samples were selected annually (in May and early June, before the hatching of the current year's brood) to determine the degree of infestation.

Ward (K. M.). **The Green Peach Aphid. Progress Report of Spraying Experiments.**—*J. Dept. Agric. Vict.*, xxxi, pt. 6, pp. 278–281, 4 figs. Melbourne, June 1933.

In view of the severe losses caused by *Myzus persicae*, Sulz., to the peach crop in Victoria, detailed investigations were conducted in 1930–32 to determine the most effective means of control. The present paper contains an account of field experiments carried out in July 1932 in two localities with winter washes to destroy the eggs. An outline of the life-history of the Aphid is given [*R.A.E.*, A, xvi, 362]. In Victoria, egg-laying is completed by the third week in June, and hatching occurs from early in July to the last week in August. The ovicides tested were : red oil (1 : 20), lime-sulphur (1 : 9 and 1 : 10) and tar distillate (1 : 30 and 1 : 40) manufactured according to the Long Ashton formula [xvii, 120]. The spray pump used had a pressure of 250 lb. per sq. in., the average amount applied to each tree being 1·2 gallons. In every case a single application was made. Examination of the treated trees in the following spring (first week in October) showed that the best results were obtained from tar distillate, which killed very nearly all the eggs, though the other washes appreciably reduced the infestation. The importance of correctly timing the application is emphasised [xviii, 467].

Ward (K. M.). **Winter Treatment of Orchard Insects.**—*J. Dept. Agric. Vict.*, xxxi, pt. 6, pp. 285–287, 4 figs. Melbourne, June 1933.

Information is given in a popular form on control measures that can be applied in winter against *Myzus persicae*, Sulz., on peach, *Aspidiotus perniciosus*, Comst., and *Cydia pomonella*, L., on apple and pear, and red spider [*Paratetranychus pilosus*, C. & F.] and *Bryobia* [*praetiosa*, Koch] on apple, pear, almond and other fruit trees. The remedies advocated include spraying with lime-sulphur (1 : 10) or red oil (1 : 20) during July and early August against the scale or the mites, and with

tar distillate (1 : 35) against the Aphid, and banding of trees, screening of packing sheds and burning waste fruit and rubbish to destroy the codling moth.

CONNELL (R. P.). **The Grass Grub and its Control.**—*N. Z. J. Agric.*, xlvi, no. 6, pp. 332–337. Wellington [N.Z.], 20th June 1933.

An account is given of the bionomics of *Odontria zealandica*, White (grass-grub) in New Zealand, the larvae and adults of which have been causing serious damage to pastures and root crops during recent years ; the injury, however, has often been erroneously attributed to other pests, and statements have been published involving misconceptions as to the nature and control of the Melolonthid.

The information given on the biology of this beetle has already been noticed [*R.A.E.*, A, viii, 503 ; x, 90]. The control measures advocated include the following : grazing cattle on infested land, as the trampling of the animals will consolidate the soil loosened by the grubs and restore the rise of water to the surface ; the application of top-dressing to assist the development and resistance of the plants ; making conditions unattractive for egg-laying by keeping the ground bare of vegetation in November and early December, when the main swarming of the beetles and oviposition take place ; sowing for this purpose rape or turnip in pasture land in October and November ; the cultivation in late spring of badly infested grassland and keeping it fallow until the autumn, when it can be sown with summer forage crops, linseed or possibly barley. The date of sowing should be adjusted so that the crops will not provide appreciable cover when the main swarm of beetles may be expected ; crops sown in October and from the last week in December are likely to escape heavy infestation. Recent experiments in controlling the grass-grub with chemicals [xx, 557] are reviewed from the literature.

LEVER (R. J. A. W.). **Insects of the Coconut Palm in the British Solomon Islands. List I.**—*Brit. Solomon I. Prot. Agric. Gaz.*, i, no. 2, pp. 4–5. Tulagi, April 1933.

In this preliminary list, the insects found on coconut in the Solomon Islands, most of which have been previously recorded [*R.A.E.*, A, xxi, 360, etc.], are classified according to the position that they usually occupy on the palm. Two Cetoniids, *Macronota regia*, F., and *Glycyphana brunnipes*, Kby., and the Rutelid, *Parastasia inconstans*, Fairm., are included as doubtful pests, and seven species are recorded as pollinators and flower visitors.

TRÄGÅRDH (I.). **Methods of Automatic Collecting for Studying the Fauna of the Soil.**—*Bull. Ent. Res.*, xxiv, pt. 2, pp. 203–214, 8 figs., 8 refs. London, July 1933.

To test the efficiency of automatic methods of collecting the soil fauna, based on their reactions to light and drought, experiments were made with an apparatus similar to that devised by Berlese in 1905 as modified by Tullgren in 1917, the accuracy of which for purposes of statistical comparison has never been ascertained. Three samples of soil material as uniform as possible were laid on sieves in cylindrical funnels, one being illuminated from above by a 40-watt lamp, producing a temperature in the soil of 40–50°C. [104–122°F.], one by a 25-watt lamp,

producing 30–40°C. [86–104°F], and the other exposed at laboratory temperature (17–20°C. [62·6–68°F.]) as a control, and records were kept of animals (chiefly Acarina) that escaped from them into collecting cups placed below. The temperature was noted, the material weighed and the cups changed every hour over a period of 24 hours. Samples were taken from the floor of a spruce forest, from a tuft of moss (*Leucobryum*) growing on a cliff, and from a peat moss (*Sphagnum*).

The following is mainly taken from the author's summary of his conclusions: The lamp suspended above the material has a twofold action, one direct and immediate resulting in the rapid downward migration of negatively phototropic animals; and the other slow and indirect, due to the lowered humidity of the soil, resulting in a downward migration that accelerated rapidly when the threshold of desiccation was reached, the latter varying with different soils.

Tullgren's method (with the 40-watt lamp) was successful in making rapid catches (in 3–4 hours) of the larger Collembola and other insects, but it was not satisfactory for material from damp and dark biotopes, especially when small thin-skinned Acarina were numerous. A 25-watt lamp gave the best results with material from dry biotopes, such as the moss on cliffs. Too rapid drying apparently caused the death of thin-skinned Acarina before they could escape into the cup. The process of collection may be made more rapid by keeping the soil samples for 2–3 days before treatment in a closed box containing suspended calcium chloride, so as to lower humidity about 50 per cent. The animal communities of the separate biotopes differ so much in composition and reaction towards light and low humidity that it is impossible to draw any conclusions from one sample concerning treatment of another.

BARNES (H. F.). **Gall Midges (Cecidomyidae) as Enemies of Mites.**—*Bull. Ent. Res.*, xxiv, pt. 2, pp. 215–228. London, July 1933.

In this paper, which is the third of a series on zoophagous Cecidomyiids of the world [*cf. R.A.E.*, A, xviii, 199], a further record of gall midges attacking Tingids, Psyllids, Aleurodids and Coccids is included. An annotated list of Cecidomyiid larvae that have been reported as preying on free-living and gall-inhabiting mites is given, together with a section dealing with those that may feed on mites and an alphabetical list of the plants on which the mites live.

LEVER (R. J. A. W.). **Status of Economic Entomology in the British Solomon Islands.**—*Bull. Ent. Res.*, xxiv, pt. 2, pp. 253–256, 10 refs. London, July 1933.

This paper includes notes on insect pests of coconut palms in the British Solomon Islands, most of the information having already been noticed [*R.A.E.*, xxi, A, 207, etc.].

The parasitism of larvae of *Tirathaba rufivena*, Wlk., by *Apanteles tirathabae*, Wlkn., on coconut is almost negligible compared with that on *Nipa fruticans*, indicating that the latter is the original food-plant. The adults of the Pyralid are nocturnal, and only the females are attracted to artificial light; the whole life-cycle averages one month and thus approximately coincides with the formation of new spadices in the palm. Lead arsenate and Bordeaux mixture tested against the Hispid, *Brontispa froggatti*, Sharp, proved more injurious to the foliage

than soap and nicotine, and except at a strong concentration was not markedly more effective. The Dynastid, *Trichogomphus semilinki*, Ritz., was also found on *Nipa*, *Poinciana regia*, mangrove and banana.

THORPE (W. H.). **Notes on the Natural Control of** *Coleophora laricella*, **the Larch Case-bearer.** (With an Appendix by C. FERRIÈRE.)—*Bull. Ent. Res.*, xxiv, pt. 2, pp. 271–291, 20 figs., 19 refs. London, July 1933.

An account is given of a preliminary survey of the parasites of *Coleophora laricella*, Hb. (larch case-bearer) in Europe. This Tineid attacks *Larix europaea* in Europe, *L. laricina* in North America and *L. leptolepis* in Japan. The incubation period in western England is about 10–14 days ; the larvae mine in the needles for 6–8 weeks, forming their cases in September. Pupation begins about the second week in May [*cf. R.A.E.*, A., xii, 421].

A list is given of the parasites reared, some of which are new to the British fauna. The Ichneumonid, *Angitia nana*, Grav., was the most abundant parasite in England, the highest degree of parasitism for 1929–30 being 68 per cent. in one batch from trees 11–18 years old. The percentage was lower on older trees. Emergence began in the insectary on 2nd June and continued for 2–3 weeks ; under natural conditions in western England it would begin a few days later. The adults remained on the wing till about 10th–15th September. The female lays an egg in the young larva within its mine during July and the first half of August, though females taken on 28th August contained 50–100 well developed eggs. The first-instar larva inhabits the haemocoele and feeds little until the host beings to be active in spring, when it passes rapidly through the remaining stages. Parasitised larvae do not pupate, and, although active, do not appear to consume much food. Finally the parasite kills the larva and pupates in the case beside the empty skin. A list of other recorded hosts is given. *A.* (*Dioctes*) *elishae*, Bridg., may be a synonym of *A. nana*.

Chrysocharis (*Entedon*) *laricinellae*, Ratz., normally a primary, but under some conditions a secondary, internal larval parasite, is responsible for an average parasitism of about 1·5 per cent. It overwinters either as a full-grown larva or as a pupa, emergence commencing at the end of April and continuing into July. There is probably a partial second brood, and adults were observed in the field up to the end of August. *Dicladocerus* (*Eulophus*) *westwoodi*, Steph., which began to emerge in early May and was found as late as the end of September, parasitised about 2·9 per cent. of 1,750 larvae. Oviposition takes place on the young larva within its case. *Eulophus metalarus*, Wlk., which is, so far as is known, a primary external parasite, was reared in small numbers in the winter of 1930–31. The adults emerged in the insectary from 9th to 20th May, the ratio of males to females being nearly 3 : 1.

Of the two Braconids reared, *Microdus pumilus*, Ratz., has been recorded only from Germany. It was rare in England, but abundant in material from southern France, in which there was a parasitism of 12 per cent. It is an internal parasite, overwintering as a first-instar larva, and is probably single-brooded. Emergence began on 21st June. *Sigalphus caudatus*, Nees, was obtained from larch in December 1930, presumably from *C. laricella*. A list of its other recorded hosts is given.

Less common parasites were the Eulophid, *Cirrospilus pictus*, Nees, with its varieties, *arcuatus*, Först., and *immaculatus*, Thoms., all of

which were found in France but only the last-named in England, *Eupelmus* sp., and the Pteromalids, *Habrocytus* sp., and *Eurydinota laricinellae*, Ratz.

The Capsid, *Deraeocoris* (*Capsus*) *ruber*, L., was common on larch trees infested with the case-bearer, but there was no direct evidence that it was predacious. The most important bird predators were tits (*Parus* spp.).

Damp conditions and heavy rains during the flight period cause high mortality among the moths, and on dry, sunny slopes where larch trees are most healthy they are generally also most heavily infested. In England, the heaviest infestation observed was in a plantation of 11-year-old trees, 750 feet above sea level. On the other hand, attacks have sometimes been more severe on trees exposed to sudden changes of temperature and late frosts ; this may be due to the fact that, although the moths are less numerous, the damage caused is more severe owing to the injurious effects of such conditions on the trees. The fact that in mountainous country more damage occurs at low altitudes is probably due to the earlier appearance and slower growth of the needles in such sites, which exposes them to attack for a longer period.

Systematic notes on the Chalcidoidea concerned are given in the appendix, together with a key to the genera.

WHITFIELD (F. G. S.). **The Bionomics and Control of** *Dysdercus* **(Hemiptera) in the Sudan.**—*Bull. Ent. Res.*, xxiv, pt. 2, pp. 301–314, 3 figs., 4 maps, 5 refs. London, July 1933.

A detailed account is given of the bionomics and control of the species of *Dysdercus* that are important pests of rain-grown cotton in the Sudan, the work having been based on the results of preliminary investigations by other workers [*cf. R.A.E.*, A, xvi, 156]. The distribution of these bugs is dependent upon several closely interconnected factors, of which rainfall is the most important, and in this region they have only been found in two districts north of latitude 14°N. Of the four species, *Dysdercus fasciatus*, Sign., *D. superstitiosus*, F., *D. nigrofasciatus*, Stål, and *D. cardinalis*, Gerst., the first occurs in the northern rain-belt and the other three in the southern. The bolls are first attacked when half-grown and slightly over 1 in. in diameter. Secondary damage is caused by fungi and bacteria that enter through the stylet punctures [*cf.* vi, 454, etc.]. The gravity of the infestation is seldom appreciated until yellowing of the lint in open bolls becomes apparent.

D. cardinalis, which is less abundant than the other species, is found breeding on *Sterculia cinerea* as well as on cotton. The life-history of *D. nigrofasciatus* is believed to be identical with that of *D. superstitiosus*, except that it is less abundant and it has never been found on *Sterculia*.

Observations on the life-history of *D. superstitiosus* were made in one Province, but the details are probably similar all over the Sudan. Oviposition takes place in the surface soil, and the incubation period is $6\frac{1}{2}$ days. There are 5 nymphal instars, the lengths of which vary slightly with the food-plants and climatic conditions, but on an average are : 1st instar, 3 days ; 2nd, 4 days ; 3rd, 5 days ; 4th, 6 days ; and 5th, 8 days. Various herbaceous Malvaceae appear to be the most

permanent of several wild food-plants. At the end of the October rains the bugs migrate from these to cotton, on which the bolls are maturing, and thence to the ripening fruits of *S. cinerea*, on both of which they multiply rapidly during November and December. Towards the end of December they tend to leave the cotton and maintain themselves on *Sterculia* and Malvaceous weeds growing in damp situations. They may persist on cotton, however, where the habitat is sufficiently damp to allow the plants to remain green. During March and April they are found chiefly on *Sterculia* and Malvaceous weeds in favourable situations, more rarely on uncut cotton, and occasionally on a small fruiting shrub, *Dombeya kirkii*. After the early May rains, they migrate to the Malvaceae, where they are believed to continue breeding until October. This wide choice of food-plants allows a long breeding season.

The length of the life-cycle of *D. fasciatus* depends on temperature and humidity and to a certain extent on the amount of food available, averaging just over a month under favourable conditions. Oviposition takes place in the soil, at about $\frac{1}{4}$–$\frac{1}{2}$ inch deep, and the incubation period is normally not less than 7 days. There are 5 nymphal instars, the first lasting 2 days, the second 6, the third and fourth 5 each, and the fifth 7 days. The natural food-plant is the baobab tree (*Adansonia digitata*), the fallen seeds of which are the sole means of existence other than cotton in one district. The bugs cluster on the trunks of these trees, generally within 10 feet of the ground, and as the colonies increase, a large number of adults migrate, either in small scattered bands, singly or in pairs. In favourable conditions breeding continues throughout the year but decreases during the dry season. They migrate from the baobabs during the cotton season, and remain on the cotton until it is cut or until insufficient moisture causes them to leave.

None of these species has a true resting period, adverse conditions merely inhibiting reproduction or even causing death. In the southern rain-belt, where the dry season is shorter and less dry than in the northern one, the bugs are affected less by climate than by range of food-plants. It is apparently only the absence of the baobab that prevents *D. fasciatus* from flourishing in this area.

There are no natural enemies of any importance, but certain Reduviids, chiefly *Phonoctonus lutescens*, Guér. & Perch., attack the nymphs and adults, and the Tachinid, *Bogosiella pomeroyi*, Villen., attacks the three southern species in one district.

Among the control measures tried in experimental areas since 1930 against *D. fasciatus*, spraying the baobabs with commercial kerosene about 10 days after the cutting and burning of the cotton stalks, which is a legally compulsory measure, killed most of the bugs. An ideal control measure would be the eradication of the baobab, but as these trees have some economic value, this is probably impossible. Failing this, the destruction of the cotton stalks should be carried out as early as possible, at least by the end of March ; all infested baobabs should be cut back after spraying, and all fruit on the ground and on the trees should be collected and burned ; all small shrubs and trees within a radius of 30 feet from the tree trunks should be cut down and all débris in this area should be destroyed. The method of spraying is described ; the ground débris should be piled round the tree trunks, sprinkled with kerosene after the trees have been sprayed and then set alight, the hot flames reaching every part of the adjacent ground and every hiding place effectively.

STOREY (H. H.). **Report of the Plant Pathologist.**—*5th Ann. Rep. E. Afr. Res. Sta. Amani, 1932–33*, pp. 13–17. London, H.M.S.O., 1933.

Experiments were carried out at Amani, Tanganyika, with *Cicadulina mbila*, Naudé, the vector of streak disease of maize, to test the theory that the virus, having been ingested, passes through the intestine to the salivary glands and is ejected with the saliva in feeding, and also that it multiplies in the body of the insect, thus maintaining the concentration in the salivary glands. The existence of two races of *C. mbila*, one able and one unable to transmit the virus [*R.A.E.*, A, xx, 717], provided an exceptional opportunity for comparative studies. A method of mechanical inoculation of the virus into insects was employed, by which the virus-bearing fluid was introduced into a puncture in the abdomen or leg with a finely pointed needle or glass micro-pipette, under the microscope. The presence of the virus could be detected, in insects that survived, by feeding them on healthy seedlings. By the same technique, fluid from different parts of one insect could be transferred by needle to others.

The virus was proved to occur in the rectum of recently fed individuals, from which it apparently disappeared rapidly on the voiding of the contents as faeces. A few hours after feeding it was present in the blood of insects of the "active" race, and within a short time they were capable of infecting plants on which they fed, presumably owing to the passage of the virus through the salivary glands, though this has not yet been proved. Insects that had not fed on diseased plants became capable, when artificially inoculated, of transmitting infection, but only irregularly and for a short period, apparently because the virus had not multiplied. Insects of the "inactive" races were rendered infective by needle inoculation into the blood, but not by feeding on diseased plants, the virus being prevented from entering the blood by some property of the wall of the intestine. They often became infective, however, when some part of the intestine was punctured by a sterile needle thrust into the abdomen immediately before or after feeding on a diseased plant. They were never found capable of transmitting the disease if uninjured.

When other sucking insects were inoculated with the virus of streak disease and *C. mbila* with those of maize stripe and mosaic diseases, the methods employed for the inactive race of *C. mbila* and the streak disease virus proved unsuccessful. Thus in relation to a particular virus there are three classes of insect: those able to transmit, those unable to transmit normally owing to a mechanism of resistance that may be overcome, and those apparently unable to transmit under any circumstances.

Work with *C. zeae*, China, indicated that its ability to transmit streak disease [xxi, 106] is controlled by a hereditary factor.

KIRKPATRICK (T. W.). **Report of the Entomologist.**—*5th Ann. Rep. E. Afr. Res. Sta. Amani, 1932–33*, pp. 17–19. London, H.M.S.O., 1933.

Investigations were made during 1932–33 in Kenya into the micro-climates prevailing in plantations of *Coffea arabica*, with particular reference to their relation to the ecology of insect pests. Numerous quantitative collections of insects in different situations were made,

but the results have not yet been correlated with studies of the eco-climates of the bushes. Since the larvae of *Leucoptera coffeella*, Guér., were found capable of withstanding temperatures at least as high as 44·5°C. [112·1°F.], it is probable that the optimum for the species is also high, but though infestations usually begin in the parts of the bush most exposed to direct solar radiation, they seem generally to continue longest where the eco-climate is comparatively cool and the foliage less fully exposed to direct sunlight. This may, however, be explained by the fact that the parasites of the leaf-miner are apparently most active (at any rate after the outbreak has been in progress for some little time) among those larvae in leaves exposed to the sun, which suggests that their optimum temperature is even higher than that of their host.

SOUTHERN RHODESIA. **Government Notice no. 367.**—*S. Rhod. Govt. Gaz.*, 1933, pp. 353–354. Salisbury, Rhodesia, 9th June 1933.

Under the Tobacco Pest Suppression Act, 1933 [*R.A.E.*, A, xxi, 423], *Ephestia elutella*, Hb., and *Lasioderma serricorne*, F., are declared to be pests of stored tobacco. Regulations governing the granting of licences are specified [*cf.* xix, 509]. The period after which owners must cleanse their warehouses is fixed at one month after handling has been completed. An Aleurodid [? *Bemisia* sp., *cf.* xx, 330] (tobacco whitefly) is declared to be a pest of growing tobacco for the purposes of the Act. By 1st August in any year the owner of any land must have all growing tobacco plants uprooted and destroyed including living stalks and roots and all plants declared to be its alternative food-plants. The method of destruction must be by burning, conversion into manure or any other method approved by an Inspector.

Entomological Investigations.—*18th Ann. Rep. Exptl. Res. Sta. Nursery Mkt. Gdn. Ind. Devpmt. Soc. 1932*, pp. 49–57. Cheshunt, Herts., 1933.

E. R. Speyer reports (pp. 49–55) that the treatment of manure for use on mushroom beds with flake naphthalene in Britain did not protect them from invasion by Mycetophilids, of which *Sciara auripila*, Winn., was the most important in 1931, or from supposedly injurious insects, such as the springtails, *Xenylla mucronata*, Ax., and *Sinella caeca*, Schott, the latter of which was only present in small numbers. Females of *Tetranychus telarius*, L., taken from *Arum* fed and bred freely on tomato and cucumber, whereas those taken from *Buddleia* did so on cucumber but not on tomato. The treatment of potted tomato plants to determine whether the taking up of various salts in the plant-sap would influence the activity of *T. telarius*, indicated that the resulting unbalanced growth is likely to increase, rather than decrease, infestations. In attempts to utilise in poison baits the attractiveness to woodlice of dried blood used as a top-dressing in the culture of cucumbers and tomatos, the best results were got by mixing Paris green with it at the rate of 1 : 56 parts by weight ; the mortality was not appreciably greater at 1 : 28, but at 1 : 100 it was considerably less. Potassium bichromate (1 : 28) gave a high mortality within a week in warm weather, but proved disappointing under less favourable conditions.

Breeding experiments established conclusively the identity of the three common species of thrips. *Thrips major*, Uzel, is entirely distinct from *T. fuscipennis*, Hal., of which it was considered by Priesner

to be a variety [*cf.* xx, 483]. It occurs in rose flowers in the field and only rarely in the late summer under glass, together with *T. fuscipennis*. The males of the two species are very different, and constant characters by which the females may be distinguished have now been found. *T. tabaci*, Lind., is entirely parthenogenetic under glass and is generally so in the field. Males of this species sent from out-door plants in Scotland differ entirely from those of the two previously mentioned species and do not agree with Priesner's description of *T. tabaci*, which refers to the male of *T. fuscipennis*, whereas that given for *T. fuscipennis* refers to the male of *T. major* [*cf. loc. cit.*]. In fumigation experiments with roses and other flowers, naphthalene gave good results after 14 hours against the larvae and both sexes of *T. fuscipennis* and *T. major*. In view of the danger to the plant when large quantities are used, experiments were made in combining another substance effective against thrips with a smaller quantity of naphthalene. The application of a dust of 6 oz. naphthalene and 0·3 fl. oz. nicotine to the floor of a glass house of 1,500 cu. ft. capacity killed approximately all the males and 80 per cent. of the females of both species, together with the three larvae present. It also killed *T. tabaci* on *Arum* flowers almost instantaneously, and gave good results against *Hercothrips* (*Heliothrips*) *femoralis*, Reut. (hot-house thrips), a pest of *Crinum* and other hot-house plants.

According to O. B. Orchard and W. H. Read (pp. 55–56), in exhaustive tests, a sulphonated crude oil derivative substituted for the emulsified petroleum oil sprays now in general use against *Tetranychus telarius* on tomato [xx, 484] controlled the pest at a lower oil concentration but caused slightly more oedema. Difficulty in killing *T. telarius* on tomatos in one nursery was found to be due to the presence in the water used for diluting the petroleum oil stock emulsion of suspended and colloidal matter, liberated from the rust in the pipes by the action of a water softening compound.

Orchard (p. 57) describes experiments in the control of the Mycetophilids, *Plastosciara perniciosa*, Edw., and *Pnyxia scabiei*, Hopk., which caused serious damage to cucumbers in pots and after planting out in many nurseries during the early part of the season. Of numerous chemicals tested as possible substitutes for a 0·1 per cent. mercury bichloride spray, which though satisfactory against the larvae on old plants in borders, hardens young potted plants, a 0·001 per cent. nicotine spray was the most effective. The addition of a sulphonated oil product prevented the yellowing that resulted from the frequent applications required.

AUSTIN (M. D.) & MARTIN (H.). **The Incorporation of Contact Insecticides with protective Fungicides. Potato Field Trials, 1930–1932.**—*J. S.-E. Agric. Coll. Wye*, no. 32, pp. 49–58, 11 refs. Wye, Kent, July 1933.

An account is given of field trials, carried out in southern England in 1930–32, with various combinations of contact insecticides and protective fungicides for the control of potato blight and potato deterioration. Since the latter is generally believed to be due to the accumulation of various types of virus disease, in the transmission of which insects play a part, it was thought that the incorporation of nicotine or pyrethrum in the blight spray might have some effect in checking deterioration. Insects present at different times on the potato plants in insignificant numbers were : *Myzus solani*, Kalt. (*pseudosolani*, Theo.), *M. persicae*,

Sulz., *Calocoris norvegicus*, Gmel., *Lygus pabulinus*, L., *L. pratensis*, L., and *Typhlocyba* spp. The Aphids were successfully kept in check by the sprays containing insecticides, but the control of the Capsids was less successful.

The effectiveness of Bordeaux mixture (10 : 15 : 100) in controlling blight was apparently not reduced by the addition of 0·75 per cent. concentrated sulphite lye (60°Tw.) and 0·02 per cent. nicotine or of 0·002 per cent. pyrethrins or 0·02 per cent. nicotine dissolved in cotton-seed oil (0·75 per cent.), the second and third preparations being emulsions and the third containing the Bordeaux mixture at half strength (5 : 7·5 : 100). These combined sprays did not injure the foliage, and seed potatoes saved from plants sprayed in the two previous seasons produced a greater yield of tubers.

Austin (M. D.) & Jary (S. G.). **Investigations on the Insect and allied Pests of cultivated Mushrooms. I.** *Sciara fenestralis* **Zett.**—*J. S.-E. Agric. Coll. Wye*, no. 32, pp. 59–62, 3 figs., 8 refs. Wye, Kent, July 1933.

An account is given of observations on *Sciara fenestralis*, Zett., infesting mushrooms. The stages are briefly described. An average of 25–30 eggs was laid, sometimes singly, but more usually in strings of 4–9 on the surface of the soil or the manure or on the mushrooms. Hatching occurred in 4–7 days, and the larvae immediately burrowed into the compost and entered the plant, causing characteristic damage by tunnelling extensively in the stalks and caps. After 15–20 days they pupated in the soil, some spending 2–3 days constructing a cocoon of soil particles and silken threads, whereas others pupated without making a cocoon. Emergence occurred in 8–14 days. As many as four overlapping generations may occur while a mushroom bed is normally cropping. The adults may be seen running rapidly over the surface of the beds ; they do not fly readily, but make short, jumping flights, a point which is of importance in relation to control measures. Mites, particularly the immature stages, are frequently found attached to the bodies of the Mycetophilids, and as various species attack mushrooms, they may possibly be disseminated by this means. In addition to the typical damage, larvae have been observed feeding on the mycelium, thereby preventing the formation of buttons and possibly causing the death of those already developing. The larvae appear to be gregarious under somewhat dry conditions, and it is suggested that this is in order to minimise the effects of desiccation.

Adhesive fly papers laid on the beds or suspended near the windows of the mushroom house may be of value as a supplementary control method. Where fumigation is possible, the volatilisation of nicotine sometimes gives good results and does not appear to harm the crop. Adults and young larvae, either hatching or just in the soil, may be killed by the application of 10 oz. or more of nicotine (95–98 per cent. purity) in 100 gals. water applied by means of a fine rose on a watering can instead of the usual periodical watering of the beds, beginning when the flies are first seen and repeated every few days as necessary. No damage is caused to the crop provided that soap is not employed. Freedom from infestations already in progress will not immediately result from the use of this spray, but regular applications will prevent attacks from reaching serious proportions.

AUSTIN (M. D.), JARY (S. G.) & MARTIN (H.). **Studies on the Ovicidal Action of Winter Washes, 1932 Trials.**—*J. S.-E. Agric. Coll. Wye*, no. 32, pp. 63–83, 1 fig., 5 refs. Wye, Kent, July 1933.

The following account of this progress report [*cf. R.A.E.*, A, xx, 552] is based on the authors' summary. Laboratory tests of the toxicity of spray emulsions containing various oils to the eggs of *Lygus pabulinus*, L., gave the following results. At 6 per cent. concentration, petroleum and vegetable oils are more effective than tar oils. Of 18 petroleum oils of different characteristics and bases, all but one gave complete control of the Capsid at 5 per cent., and some at 3 per cent. No correlation was found between ovicidal efficiency and the base or degree of refinement of the oils, but those that were unsatisfactory tended to be of relatively high viscosity, though other undetermined factors appear to be involved. The addition of high-boiling tar oils increased the value of the petroleum oil washes. No difference was found in ovicidal efficiency between emulsions prepared by the two-solution method and those prepared with Bordeaux mixture.

Field trials of various tar-petroleum oil mixtures, emulsified chiefly by the oleic acid method, gave the following results. On red currants, washes containing 6 per cent. semi-refined petroleum oil and 4 per cent. strained anthracene oil or a high-boiling tar oil conforming to the Long Ashton specification [xviii, 496, etc.] gave an excellent control of the Capsid. A wash containing 6 per cent. of a similar petroleum oil and potassium-o-cresylate (0·2 per cent. dinitro-o-cresol) proved inferior. No injury was caused to the bushes by any of the three washes. On black currants, washes containing 4 or 6 per cent. petroleum oil and 3 or 4 per cent. of either of the tar oils gave excellent control of *L. pabulinus* without injury to the bushes, the weaker concentrations being as efficient as the stronger.

Washes of 6 per cent. semi-refined petroleum oil and 4 per cent. "Long Ashton" tar oil or strained anthracene oil, or of 3·5 per cent. semi-refined heavy petroleum oil and 4 per cent. strained anthracene oil, or of 6 per cent. petroleum oil and 4 per cent. crude petroleum oil of a Diesel type, completely controlled Aphids on a variety of apple (Worcester Pearmain), with the exception of the last, and gave a high mortality of *Plesiocoris rugicollis*, Fall., with the exception of the third. The opening of the buds was retarded, but no permanent damage resulted. Serious injury was caused to the fruit buds of Lane's Prince Albert apples by the application of 6 per cent. semi-refined petroleum oil and 4 per cent. "Long Ashton" tar oil or strained anthracene oil, but both gave a commercial control of *P. rugicollis*. A tar-petroleum mixture consisting of 4 per cent. strained anthracene oil and 4 per cent. semi-refined petroleum oil, emulsified either by the oleic acid method or with Bordeaux mixture (4 : 6 : 100), proved as effective as general winter washes on Bramley's Seedling apple and caused no injury. Applied to Lord Derby apple, washes containing 6 per cent. semi-refined petroleum oil and 4 per cent. strained anthracene oil (emulsified with oleic acid or Bordeaux mixture as above), or 6 per cent. petroleum oil or 4 per cent. tar oil separately (both emulsified by the oleic acid method) were equally effective, except that containing tar oil only, but those containing 10 per cent. oil caused serious damage to the buds. No damage was caused nor was the time of opening of the buds affected by the application to Newton Wonder apples of 6 per cent. semi-refined petroleum oil and 4 per cent. strained anthracene oil (emulsified with oleic acid) applied at different times following mild or cold weather.

Vegetable oils at 6 per cent. proved ineffective against the eggs of *Rhopalosiphum prunifoliae*, Fitch (corn-apple aphis).

Austin (M. D.). **A Note on** *Lygus pabulinus* **L.**—*J. S.-E. Agric. Coll. Wye*, no. 32, pp. 168–170, 2 figs., 6 refs. Wye, Kent, July 1933.

In the autumn, *Lygus pabulinus*, L. usually oviposits in woody plants such as apple, currant and gooseberry, but examination of cultivated blackberry in the winter of 1932–33, in view of the steady increase of infestations, revealed the presence of numerous eggs in the shoots near the surface of the epidermis, usually in the new growth but sometimes in the older canes. There is thus reason to suppose that this habit is of more common occurrence than formerly, and it is of importance in view of the danger to other crops and the trouble resulting in the spring if it is assumed that the usual ovicidal washes cannot be applied to blackberry bushes during the winter. Also there is danger of severe infestations of blackberry early in the season, which may entail special spring and summer sprayings.

Woodman (R. M.). **Wetting, Spreading, and Emulsifying Agents for use with Spray Fluids. III. Emulsifiers and Soaps containing Spraying Oils.**—*J. Soc. Chem. Ind.*, li, no. 42, pp. 358T–360T. **IV. Miscible Oils.**—*Op. cit.*, lii, no. 2, pp. 4T–6T. **V. A partial Phase Rule Investigation of the Miscible Oil System Phenol-Water-Sodium Oleate-Toluene.**—*T.c.*, no. 25, pp. 185T–188T, many refs. London, 14th October 1932, 13th January, 23rd June 1933.

Continuing previous studies [*R.A.E.*, A, xviii, 649], the author points out that the only emulsifiers suitable for use in spray materials are those yielding stable oil-in-water emulsions [xvi, 423]. It was found that a greater degree of mechanical violence in the preparation of spray stock emulsions often resulted in the production of a suitable emulsion with materials that had proved unsuitable when shaken together by hand. Sodium silicate and linseed products were shown to be unsuitable spray emulsifiers. General formulae are given for preparing moderately stable soaps containing insecticidal and ovicidal oils and spray substances such as naphthalene. The esssential ingredients are coconut oil, resin and aqueous potassium hydroxide, to which casein was generally added as a hard-water emulsifier. When soaked in water and subsequently shaken, they yielded perfect, stable, oil-in-water emulsions, but the percentage of toxic oil that can be so held is probably too low to make them of general use as a substitute for the ordinary miscible oils.

In the second paper the author discusses the standardisation of the toxic oil in spray emulsions and recommends the use of such definite chemical substances as tetralin and dekalin. A miscible oil (*i.e.*, one that produces an emulsion on stirring into water) is a solution of an emulsifier in the oil to be emulsified, and contains also a third component that enables the emulsifier to be dissolved. Since the emulsifier is invariably a soap or resinate, the aid to dissolution is commonly a phenol. This combination is unsatisfactory for two reasons. The soaps or resinates are incompatible with very hard waters, and the phenols tend to scorch foliage. In an attempt to obviate the latter difficulty, miscible oils were made with various mixtures of fusel oil (in place of phenol) and soap, and their power of forming emulsions was tested. Some blends appeared to warrant a practical trial. The effects of incorporation of resin oil and of water were also investigated, the

latter definitely reducing the power of the mixture to form a miscible oil.

In the third paper it is shown that in a miscible oil formed of the usual three components (toxic oil, emulsifier and an aid to dissolution) the quantity of soap that can be incorporated without ceasing to give a clear solution is far too small to act efficiently when the mixture is subsequently emulsified by the addition of large quantities of water. In order, therefore, that the miscible oil may contain an adequate percentage of soap, a certain quantity of water must be included (before emulsification) with the other three components.

The four ternary systems (combinations of three components) possible in the system phenol-water-sodium oleate-toluene have therefore been studied with the object of ascertaining the boundaries between liquid homogeneity and heterogeneity of some type. The one most worthy of study seems to be that containing the aid to dissolution (phenol), water and emulsifier (sodium oleate), as the starting point for additions of toxic oil.

Roebuck (A.). **Measurements in Nature : or the Toll of Insect and other Animal Pests on the Farms of Lindsey during 1932.**—*Lincs. Nat. Un. Trans., 1932*, pp. 71–81. Louth, 1933.

The problem of determing the amount of loss suffered through insect pests and the order of their importance is discussed. In experiments in Lincolnshire with seedling wheat plants to determine the effect on the crop of loss of leaf surface, it was found that the crop was not reduced by thinning out until half the plants had been destroyed, but that after this it fell heavily, a 75 per cent. loss of plants producing a 50 per cent. reduction of crop. During 1932 several thousands of acres of crops in the county, including wheat, oats, barley, rye, peas, beans, potatoes, turnips, etc., mangels and sugar beet, clover and grasses, were examined and the incidence of particular pests noted.

The Colorado Beetle Order of 1933.—7 pp. multigraph. London, 23rd August 1933.

In view of the discovery of a small infestation of *Leptinotarsa decemlineata*, Say, in England near Tilbury Docks, this Order, which came into effect 23rd August 1933, has been passed under the Destructive Insects and Pests Act 1877–1927 to enable the Minister for Agriculture and Fisheries to take steps to prevent the spread of the beetle. It provides that the occupier of any land on which it exists or is suspected to exist shall at once notify the Ministry, and authorises inspectors to examine any crop upon any land on or near which the beetle is believed to exist, and also to enter any place that has been declared infected under this Order and if necessary treat, remove, or destroy crops, for which compensation will be paid. Except with the authority of an inspector, no infested (or supposedly infested) crop may be sprayed or treated, no parts of potato or tomato plants may be removed from an infected area and no live beetles may be kept in captivity.

Pemberton (C. E.). **Entomology.**—*Ann. Rep. Comm. Expt. Sta. Hawaii. Sug. Pl. Ass. 1932*, pp. 18–22. Honolulu, 1933.

Greater damage appears to have been caused to sugar-cane by *Anomala orientalis*, Waterh. (cane root grub) in one plantation in

Hawaii during 1932 than in either of the previous years, despite the great abundance of *Scolia manilae*, Ashm. Hilling up young cane in badly infested areas appears to have been advantageous to the injured plants through the enlargement of their root systems. No serious development or damage was found in areas known to be infested in two other plantations, though a slight spread took place. In general, *Rhabdocnemis obscura*, Boisd., has been controlled by the parasite from New Guinea [*Ceromasia sphenophori*, Villen.], though considerable damage is still caused on some plantations. The extensive outbreaks of *Cirphis unipuncta*, Haw., and *Spodoptera mauritia*, Boisd., in cane and grasslands have entirely subsided owing to the action of the various parasites and probably other unknown factors. Arsenical dusts containing a small amount of mineral oil have been usually found in tests to be of more value than the standard dust formula [*cf.* xxi, 347]. Despite the presence of *Bactra truculenta*, Meyr., and *Athesapeuta cyperi*, Mshl., nutgrass [*Cyperus rotundus*] is still abundant, though the weevil appears to be increasing slowly, having been found damaging 59 and 39 per cent. of the stems in two areas during April 1932. A distinct benefit has resulted from the establishment and breeding of *Anagyrus saccharicola*, Timb., in fields of sugar-cane infested with the pink sugar-cane mealybug [*Trionymus sacchari*, Ckll.], and parasitism is high in most localities, an average of 44·5 per cent. and an instance of 100 per cent. having been recorded. A total of 84,140 individuals of the Philippine species of *Scymnus* (*Pullus*) [xx, 23] have been bred and liberated, but as yet there are no indications of its establishment. During the year, *Scelio pembertoni*, Timb., an egg-parasite of the Chinese grasshopper [*Oxya velox*, F.], was found established in two localities in Oahu, and a further 23,045 individuals were reared and distributed. Adults of *Tiphia lucida*, Ashm., have been emerging from cocoons introduced from the Philippines [xxi, 229] since July 1932 and are being liberated against *Adoretus sinicus*, Burm. (rose beetle) in a suitable locality. The toad, *Bufo marinus*, imported from Porto Rico [xxi, 235], has been liberated in two cane fields, but the results are not yet apparent.

JACQUES (C.). **Le** *Cactoblastis cactorum.—Rev. agric. Nouvelle-Calédonie*, 1933, pp. 1085–1094. Nouméa, May 1933.

An account is given of the introduction from Queensland into New Caledonia of *Cactoblastis cactorum*, Berg., against *Opuntia dillenii*, which closely resembles the Australian prickly pear, *O. stricta*, and constitutes a danger to the island. *C. cactorum* is briefly described, and notes are given on its life-history [*R.A.E.*, A, xviii, 287]. In Nouméa there are three generations annually as compared with the normal two. In summer the life-cycle lasts 4–8 weeks, but in winter it may be as long as 6 months. Whereas in Australia *C. cactorum* shows a preference for *O. inermis*, in New Caledonia it devours *O. dillenii* with equal readiness, but is less inclined to feed on *O. tomentosa*, which is fortunately less abundant. Less than a year after its introduction, in the third generation, *C. cactorum* has become well established in one locality. At other points establishment does not appear to have been so successful, and a further attempt will have to be made.

FRAPPA (C.). **Un nouveau parasite du cocotier à Madagascar** *Eugnoristus monachus* **Ol. var.** *alluaudi* **Hust.**—*Bull. écon. Madagascar*, N.S. no. 76, 2e partie, pp. 55–56, 2 refs. Tananarive, March 1933. [Recd. July 1933.]

Descriptions are given of the adult and larva of the Curculionid, *Eugnoristus monachus* var. *alluaudi*, Hust., the larvae of which have recently been found attacking coconut leaves in south-eastern Madagascar. The weevil larvae were numerous in June and July, tunnelling in the inner side of the petioles, on which the eggs are laid. Pupation occurs at the end of July and during August in fibrous cocoons. The adults emerge between the end of September and the middle of January. The damage caused is considerable, the infested leaves becoming yellow and drying up ; as many as 15 individuals may be present on a piece of petiole 20 ins. long. As a remedial measure, it is recommended that infested leaves should be cut off as close to the trunk as possible and burnt.

FRAPPA (G.). **Sur deux nouveaux Scolytides du genre** *Xyleborus* **nuisibles aux rameaux du caféier à Madagascar.**—*Bull. Soc. ent. Fr.*, xxxviii, no. 12, pp. 178–181, 6 refs. Paris, 1933.

In the course of the year 1932 two more borers attacking coffee have been discovered in Madagascar, *Xyleborus morstatti*, Hag. [*cf. R.A.E.*, A, xix, 736] and *X. torquatus*, Eichh. The distribution of these Scolytids, which have not previously been recorded from the Island, is discussed from the literature, and the adults are briefly described. The damage caused is similar to that done by *X. coffeae*, Wurth [xvii, 193], but the galleries made by *X. torquatus* are larger in diameter. The biology of the three species is probably similar, the greater part of the life-cycle being spent in the galleries ; in branches infested with *X. morstatti* or *X. torquatus*, larvae, pupae and adults occurred together in the tunnels. Besides pruning and destroying the infested branches, better cultivation and the use of manures and fertilisers is recommended.

TROUVELOT (B.), LACOTTE (—), DUSSY (—) & THÉNARD (—). **Observations sur les affinités trophiques existant entre les larves de** *Leptinotarsa decemlineata* **et les plantes de la famille des Solanées.**—*C. R. Acad. Sci. Fr.*, cxcvii, no. 3, pp. 273–275, 2 refs. Paris, 1933.

Artificial infestation of various Solanaceous plants by the larvae of *Leptinotarsa decemlineata*, Say, showed that *Solanum marginatum* and *S. stramonifolium* were the most attractive, and that development took place most quickly on them. The next most successful were *S. cornutum*, *S. dulcamara*, *S. gilo*, *S. andigenum* and *S. rostratum*, the last being the original food-plant of the beetle. *S. tuberosum*, *S. laciniatum* and *S. etuberosum* proved less attractive, and growth was often less rapid on them. On *S. pyracanthum*, *S. balbisii* and *S. heterodoxum* development was prolonged. On *S. atropurpureum* it was short, but the larval mortality was high. *S. ciliatum* and *S. caldasii* were not attractive. On some 20 other species tested little or no growth occurred. *Datura ferox* was greedily attacked, but the double *Datura* of Egypt was not eaten. On *Nicotiana affinis*, *N. sanderae*, and *N. polydiclia* there was complete development, but *N. rustica saufi* was little attacked and

the Paraguay variety of *N. tabacum*, *N. sylvestris*, *N. glauca* and *N. paniculata* not at all.

From these results it is concluded that there is a continuous gradation from the plants preferred by the beetle to those rejected, and notable differences in susceptibility are seen in the group of tuberiferous species of *Solanum*. Although this does not in itself suggest the possibility of obtaining edible and productive forms less susceptible to attack than those at present cultivated, it at least justifies further research.

TROUVELOT (B.), LACOTTE (—), DUSSY (—) & THÉNARD (—). **Les qualités élémentaires des plantes nourricières du** *Leptinotarsa decemlineata* **et leur influence sur le comportement de l'insecte.**—*C. R. Acad. Sci. Fr.*, cxcvii, no. 4, pp. 355–356, 1 ref. Paris, 1933.

External characters of food-plants that affect the biology of *Leptinotarsa decemlineata*, Say, such as the long or glandular hairs [*R.A.E.*, A, xx, 239] may reduce the number of the larvae on the plant but do not render it immune from attack. The most marked factors may be divided into sensitive and digestive reactions, especially those, both in the larva and the adult, that depend on touch and taste. Thus on *Solanum insulae-paschalis*, *S. pseudocapsicum* and *S. nigrum* the young larvae after a few bites cease to feed and disperse. On *S. tuberosum* and *S. dulcamara* they greedily devour the leaves. On *S. hendersoni* and *S. capsicastrum*, though they remain and feed on the leaves, they do not grow, and after 4 or 5 days they die. The result is similar on *Salpiglossis* and *Petunia*. There is no constant agreement between the larvae and the adults in their preference for different plants. *S. demissum* and *S. nigrum* are as frequently visited by the adults as is *S. tuberosum*, but in the field the first two are less favourable to larval development than is the last. *S. ciliatum* is definitely rejected by the adults, but is suitable for complete larval development. When the same stage of development occurs on different plants, there is no constant agreement in behaviour. Partial or total immunity of a plant against attack by *L. decemlineata* does not therefore depend on a single character only.

CASELLA (D.). **Lotta contro gli afidi.** [Measures against Aphids.]—*Boll. Staz. sper. Fruttic. Agrumic. Acireale*, no. 59, 10 pp. Acireale, 1932. [Recd. July 1933.]

This is a popular account of the bionomics and control of Aphids in Sicily.

LARTSCHENKO (K.). **Die Unempfänglichkeit der Raupen von** *Loxostege sticticalis* **L. und** *Pieris brassicae* **L. gegen Parasiten.** [Defensive Reaction to Parasites of Larvae of *L. sticticalis* and *P. brassicae*.]—*Z. Parasitenk.*, v, no. 3–4, pp. 679–707, 13 figs., 32 refs. Berlin, 20th May 1933.

A histological analysis of parasitised larvae of *Loxostege sticticalis*, L., and *Pieris brassicae*, L., showed that the enclosure within the tissues of the host of the eggs and larvae of the parasite did not occur through

phagocytes but through mesenchyme cells [*cf. R.A.E.*, A, xviii, 570], which assumed the rôle of connective-tissue cells. Phagocytes subsequently dissolved or digested the enclosing capsules.

KOMÁREK (J.). **Wichtige Neubeobachtungen aus der Biologie der Nonne.** [Important new Observations on the Biology of the Nun Moth.]—*Anz. Schädlingsk.*, ix, nos. 6–7, pp. 77–82, 93–96, 1 fig. Berlin, June–July 1933.

In experiments on the effect of low temperature on the eggs of *Lymantria monacha*, L. [*cf. R.A.E.*, A, xxi, 389], fertilised eggs laid on 5th August 1931 and kept from 12th August to 5th November at −5°C. [23°F.] all produced in May 1932 healthy larvae that pupated normally, as did normal healthy eggs kept, shortly before the hatching date, from 30th April to 14th May at −10°C. [14°F.] and then transferred to normal conditions. To test the effect of high temperatures, eggs laid on 25th July were kept from 21st August to 25th October at 28°C. [82·4°F.] with a corresponding low air humidity. Those examined at the end of the period contained dead larvae, and none hatched in the following spring, though control eggs hatched normally. Nun moth eggs can therefore resist the lowest winter temperatures, but are destroyed by prolonged high summer ones, usually associated with dryness. This may explain why *L. monacha* is a coastal species in the north of Europe and a mountain one in the south. The egg adapts itself in a remarkable manner to hibernation and to hatching at that time in spring when the young larva can obtain the tender needles it requires. About 14 days after oviposition, the larva is apparently fully formed in the egg, but it does not hatch until spring.

The newly-hatched larva is fairly resistant to spring frosts and becomes more so with growth, but prolonged relative humidity under 30 per cent. kills it. It has been stated that dry weather in spring promotes development and is a direct cause of outbreaks, but careful measurements of the relative humidity under the tree crowns made from May to September, in localities where an increase or decrease of the moth was in progress, proved that in unmixed spruce stands in Bohemia (where periodic increases occur) the conditions of relative air humidity are almost constant, whether the weather be dry or rainy. As a rule, in June–August the humidity fell to 25–40 per cent. at midday, then rose with the decrease in sunshine, and remained through the night until the late morning at 70–90 per cent. No lasting change in these conditions was caused by rain or prolonged drought. The influence of weather would be more marked in an unmixed stand of pines owing to the crowns being thinner and opening upwards. The early instars were most sensitive to variations in air humidity ; from the 3rd instar onward, neither continuous rain nor prolonged drought checked development or feeding.

Of the Tachinid parasites observed, the most important, *Parasetigena sylvestris*, R.-D. (*segregata*, Rond.), has only one generation a year. It infests *L. monacha* (its only known host) only from the end of May till the host pupates. It pupates in the forest litter, where it is little affected by weather, but its numbers are reduced fully 50 per cent. by numerous enemies including Carabid and Staphylinid predators and various hyperparasites, among which are the Ichneumonids, *Mesochorus sylvarum*, Curt., and *Phygadeuon canaliculatus*, Thoms. The adults emerge in May and oviposit only after 10–14 days, oviposition extending over 14 days.

HASE (A.). **Ueber die Dauerwirkung des Mottenschutzes durch Eulan. III. Teil. Langfristige Reihenversuche an: mit "Eulan NK", "Eulan W extra", und "Eulan neu" behandelten Wollproben.** [On the lasting effect of Eulan. Part iii. Series of Experiments of long Duration with Wool Samples treated with "Eulan NK", "Eulan W extra", and "Eulan neu".]—*Anz. Schädlingsk.*, ix, no. 7, pp. 85–92, 7 figs., 2 refs. Berlin, July 1933.

This third part of a report on the effect of treatment of wool against the clothes moth, *Tineola bisselliella*, Humm., with Eulan products [*cf. R.A.E.*, A, xxi, 298] describes in detail yet further tests, demonstrating their lasting efficiency.

LINDBLOM (A.) & MÜHLOW (J.). **Två undersökningar rörande vetemyggans skadegörelse och ekonomiska betydelse.** [Two Investigations on the Harmfulness and Economic Importance of Wheat Midges.] —*Medd. CentAnst. Försöksv. Jordbr.*, no. 420 (*LantbrEnt. Avdel.*, no. 64), 24 pp., 11 figs. Stockholm, 1932. (With a Summary in German.) [Recd. July 1933.]

An analysis was made of flowers and grains of Swedish autumn wheat injured by *Contarinia tritici*, Kby., and *Sitodiplosis mosellana*, Géh., to test a laboratory method for gauging the effect of the injury on the grain yield of various varieties of wheat. Varieties with bearded ears showed the smallest percentage of injury. In a second investigation, in the autumn of 1931, which aimed at ascertaining the distribution and economic importance in Sweden of these Cecidomyiids, most of the injury was found to be due to *C. tritici*. The local distribution of each species was not ascertained. The midges occurred wherever wheat was grown, causing a total loss of about £380,000.

LINDBLOM (A.). **Jämförande försök med insektdödande vinterbesprutningsvätskor för fruktträdgården.** [Comparative Tests with Winter Orchard Sprays.]—*Medd. CentAnst. Försöksv. Jordbr.*, no. 422 (*LantbrEnt. Avdel.*, no. 65), 24 pp., 3 figs. Stockholm, 1932. (With a Summary in German.) [Recd. July 1933.]

In 1931 the effect of winter sprays was tested against the eggs of *Psylla mali*, Schm. (apple leaf-sucker) and *Paratetranychus pilosus*, C. & F. [*cf. R.A.E.*, A, xix, 695]. Three series of experiments were made in the insectary, and one in an orchard in May, *i.e.*, at about the latest possible date. The products used were tar distillates, alone or combined with mineral oil, and miscible oils and mineral oil emulsions from various sources. Tar distillates alone had a great effect on the eggs of *P. mali*, and much less on those of *P. pilosus*, while the combined tar and mineral oils were somewhat less effective against the former, but perhaps more so against the latter. Some mineral oils were very good against the mite, but they were, in general, unsatisfactory against *Psylla*.

LINDROTH (C. H.). **Timotejvecklaren** (*Tortrix paleana* **Hb.**) **ett skadedjur på vallar.** [*T. paleana* and its Harmfulness in Meadows.] —*Medd. CentAnst Försöksv. Jordbr.*, no. 423 (*LantbrEnt. Avdel.*, no. 66), 32 pp., 17 figs., 2 pp. refs. Stockholm, 1932. (With a Summary in German.) [Recd. July 1933.]

Though it is distributed throughout northern and central Europe, *Tortrix paleana*, Hb., is a pest of grasses mainly in Sweden and Finland,

where it infests *Phleum pratense* and other broad-leaved grasses. It also attacks red clover (*Trifolium pratense*) in Finland and Norway, having probably migrated from grass. All stages are briefly described. The egg stage lasts about 6 days (in July), the larval about 11 months (July to the following June), and the pupal, 10–14 days (end of June or in July). The eggs are laid on the grass blades, and the larva webs the leaves together into tubes. This moth is attacked by a disease, probably bacterial, a fungus and 3 Hymenopterous parasites, of which *Glypta bicornis*, Boie, is the most important, usually appearing in almost the same numbers as the Tortricid. The Braconid, *Macrocentrus nitidus*, Wesm., is less important, from 6 to 15 emerging from each host larva. In Finland Reuter obtained the Ichneumonid, *Habrocryptus brachyurus*, Grav., but it has not been found in Sweden. The mite, *Anystis baccarum*, L., was observed feeding on newly hatched larvae. The measure advised for slight infestations is the burning over of the places where hay-stacks have stood. In the case of severe outbreaks that compel premature harvesting, the hay must be at once removed from the field and used as green fodder or dried elsewhere, preferably indoors.

LINDBLOM (A.). **Bekämpningsförsök mot myror.** [Experiments in the Control of Ants.]—*Medd. St. Växtskyddsanst.*, no. 1, 16 pp., 5 figs. Stockholm, 1933.

An account is given of the various measures employed against ants, the species most common in Sweden being *Formica rufa*, L., *Lasius niger*, L., *L. flavus*, F., and *Camponotus herculeanus*, L. Tests with various deterrents and with solutions of nicotine and of soft soap used as contact poisons were unsuccessful. Considerable mortality was caused by the use of Flit, but this method proved impracticable for general use. An emulsion consisting of 1 part carbon bisulphide, 1 part 50 per cent. solution of soft soap and 3 parts water was very effective when poured on the ant heap, but is likely to be injurious to plants. Of numerous stomach poisons, some of which gave good results in the insectary, none proved of practical value. Dusting with derris powder gave excellent results, both when applied to ant heaps and directly to ants. Applications should be made in dry weather and repeated at intervals of 1–2 days. Pyrethrum dust, whether prepared from *Chrysanthemum* (*Pyrethrum*) *cinerariaefolium* or *C.* (*P.*) *roseum*, applied in a similar manner, also proved suitable for use against ants.

LINDBLOM (A.). **Pyretrumprodukterna i insektbekämpningens tjänst.** [Pyrethrum Products used in Insect Control.]—*Medd. St. Växtskyddsanst.*, no. 2, 24 pp., 31 refs. Stockholm, 1933. (With a Summary in German.)

The various species of pyrethrum possessing insecticidal properties are reviewed, the principal ones being *Chrysanthemum* (*Pyrethrum*) *roseum*, from the ground flowers of which Persian insect powder is prepared, and *C.* (*P.*) *cinerariaefolium* (Dalmatian insect powder). An account is given of the conditions of growth and relative importance of these two species, of the treatment of harvested plants, and of their insecticidal constituents and the effect produced by them. The author's experiments as to the possibility of growing pyrethrum in Sweden are described. Whereas *C. cinerariaefolium* succumbed almost entirely during the first winter, *C. roseum* proved much more hardy,

the harvests of 1931 and 1932 being twice as large as that of 1930. Comparative tests showed that a good quality of *C. cinerariaefolium* as well as of *C. roseum* can be grown in the neighbourhood of Stockholm. The insecticidal value of the dried plant tissue from the latter is about 67 per cent. of that of a similar weight of the former.

The conditions under which pyrethrum products may be used are outlined, and statistics are given to show to what extent the cultivation of *C. roseum* could be carried on in Sweden.

LUNDBLAD (O.). **Kålflugorna. Om några i de odlade kålväxternas rot- och stamdelar levande flugarter, särskilt med hänsyn till större kålflugan** (*Hylemyia floralis* **Fall.**). [The Cabbage Flies. Concerning some Anthomyiids living in the Roots and Stems of cultivated Crucifers, with special Reference to *Phorbia floralis*, Fall.]—*Medd. St. Växtskyddsanst.*, no. 3, 103 pp., 35 figs., 19 tables, 9 pp. bibliography. Stockholm, 1933.

A detailed general account is given of the Anthomyiids attacking cruciferous crops in Sweden, with a record of their occurrence from 1911 to 1929. It appears that swedes are more heavily attacked than turnips, and cauliflower and white cabbage more so than other varieties such as savoys, brussels sprouts, etc. The attack is more intensive in drought and hot weather, probably because the larvae develop more rapidly in heat.

Phorbia (Hylemyia) floralis, Fall., is the most abundant and generally distributed species. Others occurring in small numbers locally are *Hylemyia fugax*, Mg., *P. cilicrura*, Rond. (*H. fusciceps*, Zett.), *P.* (*H.*) *florilega*, Meade, and *Fannia canicularis*, L.; and even more rarely *P.* (*H.*) *dissecta*, Mg., *P.* (*H.*) *brassicae*, Bch., *H. antiqua*, Mg., and *F. scalaris*, F.

A list is given of 20 species of flies, including those mentioned, recorded on crucifers from various localities in Sweden. Descriptions are given of the adults and immature stages of 13 species, including, in addition to those already named, *Prosalpia billbergi*, Zett., *Hydrophoria linogrisea*, Mg., *Anthomyia pluvialis*, L., and *Ophyra leucostoma*, Wied. Observations of the dates of hatching of the more important species are recorded, together with a brief general review of the life-history. The first eggs have been observed at various dates between 28th June and 29th July, though they are probably laid both earlier and later. They hatch after two days, and the larvae immediately bore into the roots, the greater part of which are often destroyed. The larval stage lasts about 14 days in summer heat, and the pupal stage about the same time. There are at least two generations a year. Other cruciferous food-plants observed by the author, and considered to be probably the original ones, are *Sinapis arvensis*, *Barbarea vulgaris*, *Capsella bursa-pastoris* and *Thlaspi arvense*.

The natural enemies of the cabbage flies are discussed, the most important in Sweden being the Cynipid, *Cothonaspis rapae*, Westw., and the Staphylinid, *Aleochara bilineata*, Gyll., descriptions of which are given. A number of Braconid parasites were also reared from Anthomyiid material, including *Dacnusa stramineipes*, Hal., *D. areolaris*, Nees, *D. temula*, Hal., and *D. tristis*, Nees, from *P. floralis* and *P. florilega*, and *Phaenocarpa flavipes*, Hal., from the latter alone.

Control measures are dealt with in detail, mainly from the literature, spraying with mercury bichloride having proved the most successful of those tested in Sweden.

SUBRAMANIAM (T. V.). **The Insecticidal Properties of Indigenous Vegetable Fish Poisons.**—*J. Mysore Agric. Exptl. Un.*, xiii, no. 2, pp. 57–60, 2 figs. Bangalore, 1932. [Recd. July 1933.]

The use of pyrethrum and derris as insecticides in various countries is discussed, and an account is given of experiments on the toxicity to a number of insects of *Mundulea suberosa*, *Pongamia glabra* (hongay), the fruits of *Randia dumetorum* and *Lasiosiphon eriocephalus*, used as fish poisons in Mysore. A 0·5 per cent. extract of the entire plant of *M. suberosa* gave 100 per cent. control of the nymphs of a Jassid, *Idiocerus* sp. on mango after 24 hours [*cf. R.A.E.*, A, xix, 164], and as a contact or stomach insecticide at 1 per cent. strength, it gave 87 and 25 per cent. control, respectively, of grasshoppers after 72 hours, the mortality in the latter case being trebled by the addition of a little molasses. The experiments with *Epilachna* [*vigintioctopunctata*, F.] on potatoes have been noticed previously [xxi, 28]. The active principle of *M. suberosa* was identified as rotenone as long ago as 1899. Various portions of the other plants extracted with alcohol, petroleum ether and chloroform gave fairly satisfactory results on the insects tested, mostly Aphids and *Bruchus chinensis*, L., *P. glabra* being next in toxicity to *M. suberosa*. *Pongamia*-oil resin soap sprayed on coffee at 2 per cent. strength killed all nymphs of *Coccus viridis*, Green, in 24 hours and adults in 48, thus comparing favourably with fish-oil resin soap generally used as a contact insecticide. The advantages of using local plants rather than arsenicals as insecticides are the cheapness and ease of procuring them and their harmlessness to man, animals and other plants.

CHERIAN (M. C.). **Pests of Ganja** (*Cannabis sativa*).—*Madras Agric. J.*, xx, no. 7, pp. 259–265. Coimbatore, July 1932. [Recd. July 1933.]

Notes are given on the more important pests of *Cannabis sativa* [hemp], cultivated in eastern and south-eastern Madras for manufacture into cakes used for smoking. Of these, *Tetranychus telarius*, L., is the most serious, causing a loss estimated at 30–50 per cent. of the crop. The mites become abundant about 3 months after sowing, which usually takes place in August–September, though sometimes they may occur earlier. Of the six varieties of hemp tested for resistance to the mite, none was found to be immune. Early sowing did not protect the plants from infestation. A spray of fish-oil, or fish-oil resin soap (1 lb. to 6 gals. water) killed the mites without affecting the quality of the cakes prepared from the plants.

The larvae of *Heliothis* (*Chloridea*) *obsoleta*, F., cause serious damage to the leaves and capsules ; the duration of the various stages is 3 days for the eggs, 26–30 for the larvae, and 12–14 for the pupae. *Amyna octo*, Guen., which attacks sweet potato (*Ipomoea batatas*), jute and *Lantana*, has not previously been recorded on hemp [but *cf. R.A.E.*, A, xvii, 237]. The eggs of this moth are laid singly on the lower surface of the leaves. They hatch in 3–4 days, and the larvae pupate after 15–19 days, usually in the soil, but sometimes in the leaves, which they web together. The pupal period lasts 8–14 days. Both these Noctuids may be controlled by hand-picking the larvae, when the infestation is not too far advanced, or by shaking the plants once in ten days and killing the larvae that drop. Dusting with lead arsenate (1 oz. to

8 oz. fine ash) leaves a small residue of arsenic in the cakes, approximately the equivalent of the usually allowed medical dose (2 mg.) in 100 gm.

Against a termite that attacks the roots, the application to the soil of crude oil emulsion in the early stage of infestation was found to be of value. Of the bugs, the Pentatomids, *Dolycoris indicus*, Stål, and *Nezara viridula*, L., were the most injurious.

A list is given of all the known pests of hemp arranged systematically, and another of the minor insect pests with notes on the nature of the injury caused to the plants.

CHERIAN (M. C.). **The Cholam Mite** (*Paratetranychus indicus* **on** *Sorghum*).—*Madras Agric. J.*, xxi, no. 1, pp. 1–6, 1 pl., 8 refs. Coimbatore, January 1933. [Recd. July 1933.]

An account is given of observations on the bionomics and control of *Paratetranychus indicus*, Hirst (cholam mite) [*R.A.E.*, A, xii, 129], which in addition to *Calocoris angustatus*, Leth., the Delphacid, *Peregrinus maidis*, Ashm. (*Pundaluoya simplicia*, Dist.), *Chilo simplex*, Butl., and *Colemania sphenarioides*, Bol. (Deccan grasshopper), is a pest of cholam (*Sorghum*), the next most important cereal to rice in the Madras Presidency. The stages are briefly described. One female laid 63 eggs in 16 days in February 1924, with a daily maximum of 9, and another deposited a maximum of 19 in a day. The larvae hatch in 3–4 days and feed on the plant sap, transforming into nymphs in 2–4 days and into adults in about another 4. Oviposition begins after 1–2 days. The life-cycle occupies 9–12 days. In experiments, an unfertilised female laid eggs from which both males and females were reared, the offspring of one of the latter again being of both sexes, though in the next generation only males were obtained. The infested leaves turn bright red and wither up ; they may be distinguished from those affected by "rust" by the presence of mites of all stages beneath a delicate web on the lower surface of the leaves. They have rarely been observed on the upper surface. They migrate by crawling from leaf to leaf or over the soil, and may possibly be spread by wind. They sometimes cause considerable loss, and though they appear to do little damage to the ears of older plants, infested leaves are not readily eaten by cattle. In the south-western region they are found on *Sorghum* planted in both irrigated and rainy areas, being most noticeable in the former from March to June ; further north they are found from December to March. Dry, hot weather is favourable to them.

Notes are given on six natural enemies, some of which have been previously noticed [xxi, 322]. The Coccinellid, *Scymnus gracilis*, Motsch., is the most important, both the larvae and adults feeding on the eggs and occasionally on the larvae and nymphs. The eggs are laid singly, generally on the silken webs of the mites, and hatch in 3–4 days, as many as 30 being deposited by one female under laboratory conditions. The larvae feed for 4–5 days and pupate usually on the lower surface of the leaves, the adults emerging in 3–4 days. Without food the beetles live 4–6 days, but with sufficient food about 3 weeks, one living 35 days. The nymphs and adults of *Scolothrips sexmaculatus*, Perg., feed chiefly on the eggs, though they may attack other stages. The larvae of the Staphylinid, *Liophaena gracilipes*, Sharp (*Oligota flaviceps*, Sharp), which destroy the eggs, pupate in the soil. The Anthocorid, *Orius* (*Triphleps*) *tantilus*, Motsch., which is of less importance but

sometimes attacks the nymphs, has a life-cycle lasting about 2 weeks. A Lygaeid, *Geocoris* sp., which sometimes punctures the nymphs and adults, has a life-cycle of about 2 weeks, the egg period occupying 4–5 days. A Gamasid mite was found actively seeking the larvae, from which it sucks the body contents.

The first plants infested should be removed and destroyed, or dusted by means of hand bellows with flowers of sulphur and road dust (1 : 4), which with some other materials gave good control of the mites and did not injure the leaves in experiments. Dusting is, however, useless when the infestation has spread and damage has been caused. The edges of fields should be kept clear of wild food-plants, such as the grasses, *Panicum javanicum* and *P. distachyum.*

MARGABANDHU (V.). **Insect Pests of Oranges in the Northern Circars.**—*Madras Agric. J.*, xxi, no. 2, pp. 60–68, 1 pl. Coimbatore, February 1933. [Recd. July 1933.]

Notes are given on the bionomics and control of over 20 species of Arthropods observed during 1930–32 on *Citrus* in the Vizagapatam district of Madras. Of these, the fruit-piercing moths, *Othreis* (*Ophideres*) *materna*, L., and *O.* (*O.*) *fullonica*, L., were the most important, the minute punctures caused by the adults on the rind of the fruits resulting in bacterial diseases and fruit-fall. The eggs of both species are usually laid on the creeper, *Tinospora cordifolia*, on the leaves of which the larvae feed ; pupation occurs in tough cocoons among dry leaves, and the pupal period lasts 10–16 days. Control measures that proved to be effective were the destruction of *T. cordifolia*, which is commonly found among hedges and cactus bushes, catching the moths at night with nets, and spraying the *Citrus* fruits with crude oil emulsion.

Serious injury to the seedlings was caused by the larvae of *Papilio demoleus*, L., *P. polytes*, L., and *P. polymnestor*, Cram., the Lycaenid, *Chilades laius*, Cram., and the Tineid, *Tonica zizyphi*, Stn. (citrus leaf-roller), all of which fed on the tender leaves. The larvae of the leaf-roller pupate in a silken cocoon inside the leaf fold ; the adults emerge in about 6 days, and when fed on molasses lived from 7 to 20 days. This moth is particularly abundant during the rainy months of August–January.

All these species occurred simultaneously on the seedlings throughout the year in varying numbers. The control measures recommended against them are hand-picking of the eggs and larvae, and spraying with lead arsenate. Another important pest of young seedlings is *Phyllocnistis citrella*, Stn. (citrus leaf-miner), the habits of which are similar to those already noticed from Japan [*R.A.E.*, A, xix, 649]. The best method of controlling this Tineid is copious irrigation in the absence of showers to assist the development of the foliage, and drenching the seedlings with tobacco decoction (1 lb. to 5–6 gals. water) at intervals of 10 days or less.

Other major pests of *Citrus* included *Aleurocanthus spiniferus*, Quaint. (citrus mealy-wing), which was common from July to March, the nymphs feeding on the sap of the tender foliage ; *Oecophylla smaragdina*, F. (red tree-ant) ; the Coreid, *Dasynus antennatus*, Kby., which attacked the fruits ; and the Pentatomid, *Antestia cruciata*, F. (jasmine bug), which fed on the juice of the leaves and flowers, causing them to drop.

Leonard (M. D.). **Notes on Insect Conditions in Puerto Rico for the fiscal Year, July 1931 thru June 1932.**—*J. Dept. Agric. Puerto Rico*, xvii, no. 2, pp. 97–137. San Juan, P.R., April 1933.

Notes are given on insects that caused economic injury in Porto Rico during the year ending June 1932, arranged under the plants attacked and including 26 species not mentioned in Wolcott's List [*R.A.E.*, A, xii, 251].

Of these the most important were: the Pyralid, *Myelois decolor*, Zell., and the Scolytid, *Stephanoderes buscki*, Hopk., on pods of algarrobo (*Hymenaea courbaril*); the Pentatomid, *Fecelia minor*, Voll., on orange fruit; the Capsids, *Collaria oleosa*, Dist., and *Cyrtocapsus caligineus*, Stål, on Para grass [*Panicum molle*] and sweet potatoes respectively; the adults of the Reduviid, *Zelus subimpressus*, Stål, on Para grass; *Carpophilus* (*Urophorus*) *humeralis*, F., on stored fruits of jobo (*Spondias dulcis*); adults of the Derbid, *Patara albidula*, Westw., on mamey (*Mammea americana*); *Pinnaspis buxi*, Bch., on palm; and the larvae of *Myelois ceratoniae*, Zell., in pods of tamarind. The Eulophid, *Chrysocharis parksi*, Cwfd., was reared from pupae of *Agromyza pusilla*, Mg., the larvae of which were found mining in pea leaves.

Horsfall (W. R.), Dowell (A. W.) & Palm (C. E.). **Relative Importance of Species of Grasshoppers in northwestern Arkansas.**—*J. Kansas Ent. Soc.*, vi, no. 3, pp. 98–104, 2 refs. McPherson, Kans., July 1933.

A list is given of 24 species of grasshoppers found in collections made at intervals of about two weeks throughout the summers of 1927, 1928, 1929 and 1931 in northwestern Arkansas in sites representative of the various habitats in which they were abundant. Species recorded by McNeill in 1899, and not included in the above list are also enumerated. *Melanoplus femur-rubrum*, DeG., which formed over 50 per cent. of the total, predominated in clover and lucerne, and *M. bispinosus*, Scud. (blue-legged locust) in dry upland pastures and in pastures of Bermuda grass [*Cynodon dactylon*]. *M. differentialis*, Thomas (yellow locust), although less common than a number of other species, seemed to do the most damage to succulent crops. *M. mexicanus*, Sauss., was relatively unimportant in these years. *Schistocerca americana*, Drury, and *S. obscura*, F., were very abundant and destructive locally. Most of the destructive species appear as adults after the middle of July, so that injury occurs in late summer or early autumn.

Papers noticed by Title only.

Chorine (V.). **De l'utilisation des microbes entomophytes dans la lutte contre les insectes nuisibles et de la destruction par ces microbes des chenilles de la pyrale du maïs** [*Pyrausta nubilalis*, Hb.]—*Acta Bot. Inst. Univ. Zagreb*, v, pp. 7–17, 43 refs. Zagreb, 1930. [Recd. May 1933.] [*Cf. R.A.E.*, A, xviii, 144.]

Vouk (V.) & Klas (Z.). **Ueber einige Kulturbedingungen des insektentötenden Pilzes** *Metarrhizium anisopliae* (**Metsch.**) **Sor.** [On some Conditions influencing the Growth of the insecticidal Fungus, *M. anisopliae*.]—*Acta Bot. Inst. Univ. Zagreb*, vii, pp. 35–58, 5 figs., 16 refs. Zagreb, 1932. [*Cf. R.A.E.*, A, xx, 318.]

Mossop (M. C.). **Description of Hopper Instars of the Red Locust,** *Nomadacris septemfasciata,* **Serv., phase** *gregaria,* **and some Changes in Adult Coloration.**—*Proc. Rhod. Sci. Ass.*, xxxii, pp. 113–118, 1 ref. Salisbury, May 1933.

Rungs (C.). **Une diaspine nouvelle du Maroc :** *Targionia regnieri* [on *Ulex spectabilis*].—*Bull. Soc. Hist. nat. Afr. N.*, xxiv, no. 5, pp. 114–117, 1 fig. Algiers, May 1933.

Gillette (C. P.) & Palmer (M. A.). **New Species of Aphids from Colorado.**—*Ann. Ent. Soc. Amer.*, xxvi, no. 2, pp. 348–367, 2 pls. Columbus, Ohio, June 1933.

Kanda (S.). **Two new Species of the Genus** *Pseudococcus* **from Yokohama and the Island of Palau** [including *P. palauensis* on Pineapple].—*Annot. zool. jap.*, xiv, no. 1, pp. 133–138, 12 figs. Tokyo, 10th June 1933.

Hille Ris Lambers (D.). **On the Species of** *Astegopteryx* **Karsch from** *Styrax benzoin* **Dryand** [*A. fransseni*, sp. n., from Sumatra.].—*Misc. zool. sumatrana*, lxxvi, 4 pp., 1 fig., 3 refs. Medan, June 1933.

Lyle (G. T.). **A Catalogue of the British Braconidae.**—*Trans. R. Ent. Soc. Lond.*, lxxxi, pt. 1, pp. 67–74. London, 30th June 1933.

Deshpande (V. G.). **On the Anatomy of some British Aleurodidae.**—*Trans. R. Ent. Soc. Lond.*, lxxxi, pt. 1, pp. 117–132, 4 pls., 14 refs. London, 30th June 1933.

Gunn (D. L.). **The Temperature and Humidity Relations of the Cockroach** (*Blatta orientalis*) **i. Desiccation.**—*J. Exp. Biol.*, x, no. 3, pp. 274–285, 5 graphs, 19 refs. London, July 1933.

Malouf (N. S. R.). **The skeletal motor Mechanism of the Thorax of the " Stink Bug,"** *Nezara viridula* **L.**—*Bull. Soc. roy. ent. Egypte*, xvi (1932), fasc. 4, pp. 161–203, 6 pls., 21 refs. Cairo, 1933.

Balachowsky (A.). **Contribution à l'étude des Aphides de France. (1re note). Sur un nouvel Aphide** [*benoisti*] **appartenant au genre** *Titanosiphon* **Newsky.**—*Bull. Soc. ent. Fr.*, xxxviii, no. 11, pp. 165–169, 13 figs., 1 ref. Paris, 1933.

Biron (M.) & Metalnikov (S.). **Etudes sur l'immunité des chenilles de** *Galleria mellonella* **envers les bacilles tuberculeux.**—*C. R. Soc. Biol.*, cxiii, no. 25, pp. 1050–1052, 2 refs. Paris, 1933.

Kluijver (H. N.). **Bijdrage tot de biologie en de ecologie van den spreeuw** (*Sturnus vulgaris vulgaris* **L.**) **gedurende zijn voortplantingstijd.** [A Contribution to the Biology and Ecology of the Starling during its Reproduction Period (including Notes on Insect Food.).]—*Versl. Meded. PlZicktenk. Dienst*, no. 69, 146 pp., 3 pls., 6 pp. refs. Wageningen, June 1933. (With a Summary in English.)

Dwyer (R. E. P.) & Allman (S. L.). **Honey Bees in Relation to Lucerne Seed Setting.**—*Agric. Gaz. N.S.W.*, xliv, pt. 5, pp. 363–371, 20 refs. Sydney, 1st May 1933.

SCHWEIZER (J.). **Verslag over het jaar 1932.** [Report of the Besoeki Experiment Station, Java, for 1932.]—*Meded. Bezoekisch Proefst.*, no. 49, 100 pp. Djember, 1933.

This report includes the following notes on pests of coffee in Java: Dusting with sulphur appeared to be effective against the green scale [*Coccus viridis*, Green]. During the wet season, the gramang ant [*Plagiolepis longipes*, Jerd.] was captured in large numbers in bamboo nest-traps. Further tests will be made against it with the method of smearing the bushes with a poison-bait of sweetened thallium sulphate. *Pseudococcus citri*, Risso, was more abundant than *Ferrisiana* (*Ferrisia*) *virgata*, Ckll. A solar oil emulsion spray killed all the mealybugs it touched, but failed to reach all those in the berry clusters. *Xyleborus morstatti*, Hag. (black twig-borer) was less harmful than in the preceding year. In its spread it was accompanied by the parasite [*Tetrastichus* sp.] from the brown twig-borer [*X. morigerus*, Bldf.] that has adapted itself to it [*R.A.E.*, A, xx, 567]. Some success attended an experiment in smearing grease on the twigs, but owing to the high cost this method is suitable only for young plantations. In one case bushes sprayed with Bordeaux mixture (rendered adhesive with resin and soap) suffered less loss of twigs.

JAYNES (H. A.). **The Parasites of the Sugarcane Borer in Argentina and Peru, and their Introduction into the United States.**—*Tech. Bull. U.S. Dept. Agric.*, no. 363, 26 pp., 10 figs., 7 refs. Washington, D.C., May 1933.

An account is given of investigations on the natural enemies of *Diatraea saccharalis*, F., carried out in Argentina from August 1928 until May 1930, and afterwards in Peru; much of the information on the method of collection and transport to the United States has already been noticed [*R.A.E.*, A, xx, 286, 287]. *Paratheresia claripalpis*, Wulp, was the commonest parasite in both countries. All the larval stages of this Dexiid occur within the body cavity of the host. The first larval instar overwintered and was of variable duration; in the laboratory, the second lasted 77–144 hours, with an average of 130·6, the third 23–54 hours with an average of 31, the prepupal period 22–72 hours with an average of 36·3, and the pupal period, which was passed in the tunnel made by the host, lasted 21·5 days on an average. The observations were made at a temperature of 80°F., but previous investigations in Argentina have shown that at considerably lower temperatures (64·3°F.) the pupal period was doubled (37–44 days.) All stages of this Dexiid are described. Pairing did not take place in wire cages, but adults fed on sugar and water and kept in cloth cages ($36 \times 16 \times 14$ ins.) paired 3–4 days after emergence. Larvae were deposited 9–10 days after pairing, and the maximum length of life was 41 days. In addition to two hyperparasites found in Argentina [*cf.* xviii, 677], two Signiphorids, *Thysanus dipterophaga*, Gir. [*cf.* v, 37], and a new species of the same genus, *Eupelmus peruvianus*, Cwfd., and *E. cushmani*, Cwfd., *Spalangia muscidarum*, Rich., a Pteromalid, *Melittobia* sp., and a Diapriid, *Trichopria* sp., were reared from the puparia in Peru.

The Tachinid, *Leskiomima jaynesi*, Aldr., was found in Argentina in small numbers [*cf.* xx, 568]. It appeared to be local and not numerous enough for study or shipment; its life-history was apparently similar to that of *P. claripalpis*.

Ipobracon tucumanus, Brèth., which was found in Argentina, probably overwinters in the adult stage ; it can withstand low temperatures, one female living one month and two living two months when kept in a refrigerator at temperatures between 43 and 50°F. In 1928 the first cocoons were not found until 16th October, but in 1929 they were found in August. Unfertilised females are capable of producing males parthenogenetically. Oviposition took place at random in the borer tunnels, the larvae feeding externally on the host and the cocoons being formed in the tunnels. When eggs were laid between 19th and 28th September, the adults emerged in an average of 45·1 days, the mean temperature during this period being 69·1°F., whereas when they were laid between 12th and 16th November, emergence took place in 25·3 days although the mean temperature was only 10 degrees higher. *I. rimac*, Wolcott, which was found in Peru, was present in large numbers in the fields, but did not cause a high degree of parasitism. In cage experiments with adults collected in the field, the incubation period was found to last from 24 to 48 hours. In an experiment at a mean temperature of 80·2°F., 8 or 9 days elapsed between oviposition and cocoon formation, and the pupal period lasted 11–14 days.

On one occasion in Peru parasitism by the Braconid, *Microdus* (*Bassus*) *stigmaterus*, Cress., reached 9·7 per cent. The pupal period ranged from 7 to 10 days. No males were reared or collected in Argentina. The winter was passed in the 1st larval instar. *Telenomus alecto*, Cwfd., which sometimes attacks the eggs of *D. saccharalis* [xx, 286], was not found in localities where this host occurred alone. The interval between oviposition and emergence of the adult in one case was 16–19 days. *Trichogramma minutum*, Riley, was quite effective in both countries, but, as in Louisiana [xviii, 394, etc.], did not show a high degree of parasitism until the end of the season. Only two adults of *Apanteles xanthopus*, Ashm., were reared (in Argentina), but a number of empty cocoons were found in small tunnels of *D. saccharalis*, indicating that the larvae are attacked just before or after they enter the cane. A small number of the Nematode, *Hexamermis microamphidis*, Steiner, was reared from borers in Argentina, but the percentage of parasitism was small. Two fungi, *Botrytis delacroixii* and *Mucor botryoides*, were of minor importance.

An account is given of the prevailing climatic conditions in the main fields of investigation and of the agricultural practices in the sugar-cane districts of both countries.

Baker (W. A.) & Arbuthnot (K. D.). **The Application of artificially prolonged Hibernation of Parasites to Liberation Technique.**—*Ann. Ent. Soc. Amer.*, xxvi, no. 2, pp. 297–302, 4 refs. Columbus, Ohio, June 1933.

The life-cycles of parasites of *Pyrausta nubilalis*, Hb., often fail to synchronise with that of their host [*cf. R.A.E.*, A, xvi, 528 ; xviii, 369 ; xx, 364]. Thus in one district of Michigan, adults of *Microgaster tibialis*, Nees, emerged from 1st to 20th May in 1930, and of *Eulimneria alkae*, Ell. & Scht. (*crassifemur*, auct.) from 15th to 25th in 1931, whereas the borers were not present in the fields until mid-July. Experiments were therefore begun in 1928 and 1929 to produce, by artificial prolongation of hibernation, adults of these parasites for liberation when the host was at a stage suitable for attack. Larvae of *E. crassifemur* and prepupae of *M. tibialis* were kept in their cocoons until 1st July at a temperature of 35°F. and a relative humidity of 90–100 per cent. and were then

allowed to emerge at 80°F. and 85 per cent. humidity. Initial establishments of *M. tibialis* were demonstrated in 1931 in almost all localities (in Michigan, Ohio, Pennsylvania and New York) where synchronised liberations had been made in July, and the artificial conditions imposed did not reduce the effectiveness of the parasite, its seasonal rhythm responding immediately to natural influences. No establishment of *E. alkae* has resulted as yet from any liberations.

McClure (H. E.). **Unusual Variation in the Life Cycle of the Male of** *Aenoplex carpocapsae* **Cush., Codling Moth Parasite.**—*Ann. Ent. Soc. Amer.*, xxvi, no. 2, pp. 345–347, 1 fig. Columbus, Ohio, June 1933.

Studies in Illinois in 1931 of the male offspring of unfertilised females of *Aenoplex carpocapsae*, Cushm., a parasite of *Cydia* (*Carpocapsa*) *pomonella*, L., revealed the existence of two types, differing markedly in the length of their life-cycles. The female punctured a host larva at random, wherever the cocoon was penetrable, and laid an egg. Incubation lasted about 54 hours, and the Ichneumonid larva fed on the host larva for 4½–8½ days. The two types became distinguishable as they grew older ; one, which was only about ¾ the size of the other, only partly devoured the host, whereas the larger consumed it all except the head and skin, but there was only about a day's difference in the average length of larval life. The cocoons of the two types, which remained inside those of the host, differed in shape. Larvae of approximately the same age and kept under the same conditions of light, temperature and humidity, had resting stages of very different lengths, the smaller type resting 1–7 days and the larger 37⅓–63½ days ; the prepupal periods were 28–32 hours and as long as 52 hours respectively, and the pupal periods 4–7¼ days and 4⅓–11 days, the fully formed adults emerging after from 4 to 50 hours. Of those observed, 13 per cent. had long life-cycles (averaging about 70 days) and 47 per cent. short ones (less than 20 days), and there was a 40 per cent. mortality. It is suggested that this variation of life-cycle within a species kept in controlled conditions may be an inherent factor that tends to produce males over a long period and so insure their presence when the females appear.

Biennial Report of the State Entomologist for 1931–32.—*Bull. Off. St. Ent. Georgia*, no. 77, 52 pp. Atlanta, Ga., June 1933.

This report includes a section by M. S. Yeomans (pp. 3–16), in which it is stated that the sweet potato weevil [*Cylas formicarius*, F.] was observed in 1932 in two localities in Georgia far removed from the commercial areas on plants probably introduced from Florida, and that a survey carried out in view of the discovery of the pink bollworm [*Platyedra gossypiella*, Saund.] on cotton in northern Florida [*cf. R.A.E.*, A, xxi, 226, etc.], did not reveal its presence in Georgia.

C. H. Alden (pp. 16–28) reports on the liberations of *Trichogramma minutum*, Riley, which were made in 1931 [*cf.* xx, 188, etc.] and 1932 in peach, apple and pecan orchards [*cf.* xix, 604] against codling moth [*Cydia pomonella*, L.], oriental fruit moth [*C. molesta*, Busck], pecan leaf case-bearer [*Acrobasis* sp.], pecan nut case-bearer [*A. caryae*, Grote] and *Enarmonia* (*Laspeyresia*) *caryana*, Fitch (pecan shuckworm). The parasite is now established in several parts of the State. The highest parasitism obtained was that of *C. pomonella*,

which averaged 77·5 per cent. of all broods in 1932, as compared with 34·3 per cent. of *C. molesta*. Tests showed that parasitism of *C. pomonella* in unsprayed orchards was inadequate for control, whereas in sprayed orchards it helped to reduce infestation. *Macrocentrus ancylivora*, Roh., liberated against *C. molesta*, has also become established. Parasitism was slight at the beginning of 1932, but later it rose to 91·3 per cent.

W. H. Clarke (pp. 28–39) states that infestation of peach by the plum curculio [*Conotrachelus nenuphar*, Hbst.] was greater in 1932 than in 1931 and that larger numbers of adults entered hibernation owing to the failure to employ supplementary control measures. Parasitism of *C. molesta* by *M. ancylivora* (partly obtained from New Jersey) amounted to 36·67 per cent. in one orchard within 6 days of a liberation in 1931. *Syntomosphyrum esurus*, Riley, also imported from New Jersey [*cf.* xx, 32], was reared in the laboratory and liberated against *C. molesta*, and some recoveries of it were made in 1932.

J. B. Gill (pp. 39–49) in a description of the work done at Albany on insect pests of pecan, records that in concentration tests, in which 2,500 individuals were placed on each tree, the average parasitism of *Acrobasis* sp. by *T. minutum* during the season was 17·05 in 1931. The parasite was found to overwinter successfully in the open. In 1931, of eggs of *A. caryae* deposited in the insectary on nut-clusters and suspended in an orchard in which liberations had been made, the only ones parasitised were 28 per cent. of those exposed within 12 ins. of the emerging parasites. In 1932, a year of light infestation, the percentage of infested nuts on trees on which *T. minutum* had been liberated was 3·96, compared with 4·38 on controls. As the result of experiments on the control of the black pecan Aphid [*Melanocallis caryaefoliae*, Davis] in a badly infested orchard, the application is recommended of either $\frac{3}{4}$ pint nicotine sulphate to 100 gals. Bordeaux mixture, or $\frac{1}{2}$ gal. penetrol and $\frac{3}{16}$ pint nicotine sulphate per 100 gals. water, or $\frac{1}{2}$ gal. Nicotrol to 100 gals. Bordeaux mixture. This Aphid and also *Callipterus* (*Monellia*) *costalis*, Fitch, were attacked in 1931 by three species of Coccinellids, *Chilocorus stigma*, Say (*bivulnerus*, Muls.) which is the commonest and is more or less active throughout the winter, *Cerotomegilla fuscilabris*, Muls., which feeds principally on Aphids and probably consumes a greater number per individual, and *Hippodamia convergens*, Guér., which is the least common. These predators are important control factors, but they do not appear in effective numbers until considerable damage has been caused.

Sanborn (C. E.). **Insect Pest Studies.**—*Rep. Oklahoma Agric. Expt. Sta. 1930–32*, pp. 244–248. Stillwater, Okla. [1933.]

Among the more important insect pests of economic crops observed in Oklahoma in 1931 and 1932, *Blissus leucopterus*, Say, has been gradually increasing where cereals and hay land are found ; since the latter is essential to the development of the bug, hay land adjacent to cultivated fields should be burnt in late autumn before 10th December. *Heliothis obsoleta*, F., seriously infested maize and cotton, except when the latter was dusted with arsenicals. Serious damage was done by *Aphis gossypii*, Glov., to melons in 1931, by *Anticarsia gemmatalis*, Hb., to soy beans in 1930, and by *Anasa tristis*, DeG., to squash and pumpkin, especially in 1931.

Hixson (E.). **Boll Weevil Control Investigations.**—*Rep. Oklahoma Agric. Expt. Sta. 1930–32*, pp. 256–265. Stillwater, Okla. [1933.]

In Oklahoma, the cotton boll weevil [*Anthonomus grandis*, Boh.] was more abundant in 1931 than in any other year since 1927, probably owing to the unusually large numbers that survived the warm and rather dry winter of 1930–31. Both in 1931 and 1932 the overwintering adults emerged mainly during the month of July, when control measures were applied in some localities, the materials tested including a molasses calcium arsenate bait [*R.A.E.*, A, xv, 138] and dusts of calcium arsenate, sodium fluosilicate and cryolite. Calcium arsenate, applied at intervals of 7 to 10 days as long as the infestation was above 10 per cent. and until the bolls matured, proved to be the most effective. In 1932, at rates from 4 to 8 lb. per acre, it was very effective during the whole summer, being the only material that kept the weevils in check. The bait kept the infestation down only until the appearance of the second generation ; sodium fluosilicate and cryolite gave poor results, and the cost of the former was too high. In cage observations in the winter of 1931–32 on the hibernation of *A. grandis* collected in the autumn, weevils disturbed from hibernation in April had already lived an average of 193 days without food ; if they had emerged normally in June, they would have lived about 220–240 days without food, indicating that they cannot be starved by delayed planting.

Whitehead (F. E.). **Preliminary Report on the Pecan Phylloxerae.**—*Rep. Oklahoma Agric. Expt. Sta. 1930–32*, pp. 265–267. Stillwater, Okla. [1933.]

The twigs, petioles and leaves of pecan trees in Oklahoma are often heavily infested with unidentified species of *Phylloxera*. On some trees more than half the leaf surface is covered with galls. The Aphids first appear about 20th April when the leaves are just beginning to unfold, and they at once settle down on the stems or mid-ribs of the leaves and begin feeding. As a result, the surrounding cells rise to form a ring, and in 3–5 days small galls, each enclosing an Aphid, begin to be formed. Oviposition begins within approximately one week from the time that the Aphid became enclosed and lasts for about three weeks, during which 1,000 or more eggs may be deposited. These hatch in 3–5 days, and the young at once begin to feed on the inside wall of the gall. Maturity is reached in 14–20 days, when winged adults are formed. Their appearance was first observed on 15th May, the gall drying and cracking open, thus permitting the young Aphids to escape. They do not fly, however, but crawl about on the leaves, stems, twigs, etc., depositing eggs ; cage observations showed that the number laid by a single female averaged 8–10, with a maximum of 15. These hatch in about 8 days and give rise to the formation of other galls. The first generations produce larger numbers of offspring than any of the later ones, since the rapid growth of the trees in spring favours the development of the galls, whereas later galls, which grow more slowly and are smaller, produce fewer Aphids.

Various predators are an important control factor, particularly a red mite, which feeds on all stages, a Hymenopterous larva, which preyed on the Aphids inside the galls, and a Capsid, which attacked all stages of the first two generations but was not present later in the season. At the beginning of August sexual forms of *Phylloxera* were found emerging from the galls ; some of the females soon after pairing laid one egg under the bark, whereas others crawled under the bark and appeared to enter

hibernation without ovipositing. It is possible that more than one species is involved, and further studies in this connection will be carried out.

BRITTON (W. E.). **Connecticut State Entomologist, Thirty-Second Report 1932.**—*Bull. Conn. Agric. Expt. Sta.*, no. 349, pp. 365–460, 23 figs. New Haven, Conn., March 1933. [Recd. July 1933.]

An annotated list (pp. 369–381) is given by W. E. Britton of a number of insect pests occurring in Connecticut during 1932. Britton and J. T. Ashworth report on work done in the control of the gipsy moth [*Porthetria dispar*, L.] (pp. 400–407). A considerable percentage of parasitism by *Compsilura concinnata*, Mg., and *Sturmia scutellata*, R.-D., and (in one instance) slight parasitism by *Anastatus disparis*, Ruschka, was found in material collected from two different localities where little control work had been done for several years. The area in which maize is attacked by two annual generations of *Pyrausta nubilalis*, Hb., work against which is reported on by Britton, M. P. Zappe and J. P. Johnson (pp. 407–411), was found to have spread in 1931 [*cf. R.A.E.*, A, xx, 701] to such a degree that the State quarantine was extended to cover the entire state of Connecticut as from 10th February 1932. This holds good in spite of the revocation of Federal Quarantine no. 43 [xx, 648]. The entire State has also been placed within the quarantined area for *Popillia japonica*, Newm., work against which is reported on by Britton and J. P. Johnson (pp. 411–415). The satin moth [*Stilpnotia salicis*, L.] was found to be present on poplar or willow in 24 additional towns, which have now been placed within the quarantined area.

P. Garman, reporting on work in the biological control of the oriental fruit moth [*Cydia molesta*, Busck] (pp. 427–429), gives a record of parasites supplied to fruit growers during the past three years, mainly *Macrocentrus ancylivora*, Roh., *Trichogramma minutum*, Riley, and *T. pretiosum*, Riley. More than 1,500,000 eggs of *C. molesta* were handled in 1932, the greatest number being 234,000 in June. Field experiments on the effect of sulphur on *Trichogramma* continued to indicate that heavy applications shortly after liberation markedly reduce parasitism, and talc dust proved even more injurious. It is sometimes advisable to avoid or reduce the use of fertilisers and other operations promoting excessive growth of twigs, since in many orchards (especially in the absence of parasites) this leads to increased infestation. Frequent applications on quince between 27th May and 1st September of lead arsenate and a special sticker and spreader controlled quince curculio [*Conotrachelus crataegi*, Walsh] fairly well, but had no effect on *Cydia molesta*.

Notes are given by Garman (pp. 433–434) on the comparative toxicity of anabasine sulphate, prepared from *Anabasis aphylla* [xx, 37], and nicotine sulphate in sprays against various Aphids and leaf-hoppers. Anabasine sulphate gave good results against *Myzus persicae*, Sulz., at dilutions of 1 : 500 and 1 : 1,000, and fair results at 1 : 2,000 without a spreader under greenhouse conditions. It was as toxic to nymphs of *Typhlocyba pomaria*, McAtee, as nicotine sulphate. Against *Aphis rumicis*, L., it was about 5 times as toxic as nicotine sulphate when diluted by volume.

Argyresthia freyella, Wlsm., is reported (pp. 437–438) from red cedar [*Juniperus virginiana*] in New York and together with *A. thuiella*, Pack., from arborvitae [*Thuja occidentalis*] in Connecticut, where it

has not previously been recorded. The larvae mine the leaves and pupate in the mines. The cocoons are described. This Tineid, which was first described from Texas in 1891, was at one time believed to be identical with the European *A. abdominalis*, Zell., which, however, is not known to occur in the United States.

Miscellaneous insects on which notes are given by Britton (pp. 445–459) include *Epitrix parvula*, F., which is recorded for the first time on growing tobacco in Connecticut ; *Anomala orientalis*, Waterh., which has occurred at several points outside the known area of infestation ; *Conwentzia hageni*, Banks, a Neuropterous predator on mites and newly-hatched Aphids, cocoons of which were found on *Retinospora filifera* in April ; *Chauliognathus pennsylvanicus*, DeG., which caused considerable injury to aster, *Calendula* and marigold ; *Tibicen* (*Magicicada*) *septemdecim*, L., which appeared in a few places in Connecticut in June 1932 ; the Pierid, *Colias eurytheme*, Boisd., which was exceptionally abundant on clover and lucerne ; *Calomycterus setarius*, Roel. [*cf.* xviii, 454] which was found in July 1932 feeding on iris, bindweed [*Convolvulus*] and *Polygonum* ; the Tineid, *Bedellia somnulentella*, Zell., the larvae of which were found mining in the leaves of *Ipomoea* and *Convolvulus* in 1931, but caused no injury in 1932 ; *Reticulitermes flavipes*, Koll., which caused severe damage in floor and structural timbers in two buildings ; and *Hypera* (*Phytonomus*) *rumicis*, L., attacking sorrel grown for seed.

In insectary studies of *Epitrix cucumeris*, Harr., discussed by N. Turner (pp. 448–449), the eggs hatched in 5–9 days, the larval period varied from 22 to 62 days, and the pupal period lasted 6–9 days. The total developmental period required 38–81 days. Overwintered adults appeared on potatoes during the last week of May. Emergence of adults of the 1932 generation began on 8th July and continued until September, there being no indication of a second brood [*cf.* xx, 41]. In a field test, the best control was obtained with 3 lb. lead arsenate and 1 U.S. pt. fish-oil in 100 U.S. gals. water ; plots sprayed with calcium arsenate or barium fluosilicate and fish-oil at the same concentration produced no greater yield than unsprayed plots.

External injury to peaches in northern Connecticut, as reported by Garman (pp. 453–454), was probably due to several pests, including *Macrodactylus subspinosus*, F., *Conotrachelus nenuphar*, Hbst., *Cydia* (*Grapholitha*) *molesta*, Busck, and *Lygus* spp. R. B. Friend gives an account (pp. 454–455) of work carried out during 1932 against the pine shoot moth [*Rhyacionia buoliana*, Schiff.], in which the removal and destruction of infested tips reduced their number by 80 per cent. in plantations of red pine [*Pinus resinosa*]. This method is best carried out during May when injury by the larvae is most conspicuous. The adults emerge during June and early July ; the eggs are laid singly on the needles and hatch in about 10 days. The larvae bore into the needles at first and then feed on the buds [*cf.* xx, 650]. Hibernation takes place in the larval stage, and feeding is resumed in the spring. Pupation takes place in the shoots in May and June, and the pupal period is about 18 days. Laboratory experiments indicate that a spray mixture containing light summer miscible oil and lead arsenate [xxi, 234] offers considerable promise if properly applied to ornamental trees.

Notes on the gladiolus thrips [*Taeniothrips gladioli*, Moult. & Stnw.] by B. H. Walden (pp. 457–458) show that as the thrips cannot survive the winter out of doors in Connecticut, it is carried over from one year

to the next in stored corms, in which it can be controlled by the use of naphthalene flakes [xxi, 319, etc.]. Where the temperature of the storage cellar is 60°F. or higher, paper bags in which the corms are placed should be kept closed for 2–3 weeks, or longer where the temperature is lower. Control on the plants is difficult, but if thrips-free corms are planted early, most of the flowers can be obtained before they become infested with migrating thrips. Where water is available under pressure, the thrips have been controlled by a driving spray applied to the plants on alternate days, and in other cases weekly applications of a good contact spray with the addition of a stomach poison until the plants are 4–6 inches high has secured good blooms. Injury to the flowers is not preventable where the plants are badly infested at the time the blossom buds begin to open.

Walden (B. H.). **Studies on the imported Currant Worm.**—*Bull. Conn. Agric. Expt. Sta.*, no. 349, pp. 416–427, 8 figs., 5 refs. New Haven, Conn., March 1933. [Recd. July 1933.]

Pteronus (*Pteronidea*) *ribesii*, Scop., which is supposed to have been imported into the United States from Europe on gooseberry bushes, was first recorded in New York in 1858 and spread in a few years throughout the United States and Canada wherever currants and gooseberries were grown. Complete defoliation often occurs before the infestation is detected, and repeated defoliation in 2–3 successive years greatly weakens or even kills the bushes. In Connecticut the adults emerge from the overwintered cocoons in the spring and eggs have been observed in the field between 16th April and 25th May, the first being laid on gooseberry, some varieties of which come into leaf earlier than currants. The eggs, which are laid low down on the lower surfaces of the leaves, hatch in 9–12 days, and the young larvae make small round holes through the leaves. They feed for 15–20 days, females having 5 moults and males 4. When fully fed, they crawl to the ground and spin cocoons under rubbish at the surface, or enter the soil for ½–2 inches, if it is not too hard. The pupal stage lasts 10–12 days after which the adults emerge and lay eggs for the second brood. First-brood adults have been observed in the field from 5th June till 18th July, and eggs are usually most abundant during the last week in June. Full-grown larvae of the second brood have been found from 17th July to 25th August. These overwinter in their cocoons, pupating only 1–2 weeks before emergence in the spring.

In the spring, when the leaves are ½–¾ inches in diameter, they should be examined for eggs, and as soon as small holes are observed, the bushes should be sprayed with lead arsenate at the rate of 1½ lb. to 50 U.S. gals. water. One application of the spray, or of any lead arsenate dust, should suffice, but in a heavy infestation a second application may be necessary to cover new growth developing after the first treatment. If treatment has been delayed until the fruit is more than half grown, hellebore or pyrethrum should be used instead of an arsenical.

Garman (P.) & Townsend (J. F.). **Seasonal Life History of the White Apple Leafhopper and Experiments in its Control.**—*Bull. Conn. Agric. Expt. Sta.*, no. 349, pp. 429–432, 1 chart. New Haven, Conn., March 1933. [Recd. July 1933.]

Extensive field counts of *Typhlocyba pomaria*, McAtee, made in apple orchards in Connecticut in 1932 showed that the first nymphs appeared

early in May, hatching being complete about the middle of June. Adults continued to appear until the middle of July, and oviposition (determined by exposure of potted apple seedlings to adults confined in cages) continued from 18th June to 13th August, reaching its maximum about 7th July. Summer-brood nymphs hatch out from 6th August to 24th September, the adults emerging and ovipositing in September–October and living on till November. Severe leaf damage was reported in various orchards. In experiments on the summer brood, sprays of nicotine sulphate and soap had some residual effect in killing eggs within the leaves or nymphs after hatching and feeding on sprayed foliage. Many more nymphs hatched from unsprayed branches than from those sprayed with 1 per cent. oil and 1 : 600 nicotine sulphate. It appears, however, that some natural enemies of the leafhopper are killed by orchard sprays, the two most prevalent parasites, a Dryinid, *Aphelopus* sp. and the Mymarid, *Anagrus armatus*, Ashm., being very delicate. The addition of 3 lb. soap to a spray of 1 U.S. pint nicotine sulphate in 100 U.S. gals. water showed no significant difference in field counts. Spraying should be directed against the lower surfaces of the leaves. Anabasine sulphate killed as many nymphs as nicotine sulphate when used at the same dilution in small field experiments.

Knowlton (G. F.) & Janes (M. J.). **Distribution and Damage by Jointworm Flies in Utah.**—*Bull. Utah Agric. Expt. Sta.*, no. 243, 15 pp., 6 figs., 18 refs. Logan, Utah, July 1933.

An investigation has been carried out to determine the distribution of some of the more important Eurytomids attacking wheat and rye in Utah and the extent of the injury caused by them. *Harmolita grandis*, Riley (wheat strawworm) [*cf. R.A.E.*, A, xix, 485] was present in all counties from which wheat samples were examined. From 1930 to 1932 inclusive, 22·4 per cent. of irrigated and 30·5 per cent. of the dry-farm wheat examined was infested, infestation reaching 100 per cent. in some localities. Two generations occur annually, larvae and pupae of the second generation passing the winter within the straw. Wingless adults (form *minuta*, Riley) emerge in spring and oviposit in the young plants. Larvae of the summer generation (form *grandis*) cause the most severe injury, killing many young plants and causing excessive tillering around the main stocks of others. Damage is most severe in a light crop. The adults of this generation are somewhat larger than those of the overwintered generation and are winged. They scatter and oviposit in succulent wheat stems, usually just above the joints, the larvae developing inside the straw.

H. tritici, Fitch (wheat jointworm) is not at the present time generally distributed in Utah, but although its spread has been slow, it is expected that it will eventually become established throughout the more important wheat-growing districts. It is responsible for the formation, near the joints of the straw, of galls that develop where the egg is laid and shelter the larvae. *H. vaginicola*, Doane, which only attacks the leaf-sheath of wheat, was extremely scarce during 1930–32, having been found in only one sample (in 1932). *H. websteri*, How. (rye strawworm) was found in several northern localities, with infestations averaging less than 10 per cent. Infestation by *H. secalis*, Fitch (rye jointworm) was negligible. An attempt was made to determine the parasites attacking *Harmolita* spp. and to estimate their effectiveness. The Torymid, *Ditropinotus aureoviridis*, Cwfd., was apparently an important factor in the control of *H. tritici*. Another Torymid,

Eridontomerus isosomatis, Riley, was obtained from *H. grandis*, and the Eupelmids, *Eupelmus allyni*, French, and *Calosota metallica*, Gah., from both *H. grandis* and *H. tritici*, but the rate of parasitism was low. Control measures consist principally of deep ploughing of stubble soon after harvest, planting at least 65–75 yards away from straw left over from the previous season, and destruction of self-sown wheat and straw stacks before emergence in the spring.

PATCH (L. H.). **The Infestation of Corn Ears by the European Corn Borer, and Cribbed Corn as an auxiliary Source of Infestation.**—*Circ. U.S. Dept. Agric.*, no. 275, 8 pp. Washington, D.C., April 1933.

The following is taken from the author's summary : The results of estimates of the population of *Pyrausta nubilalis*, Hb., in maize harvested from infested fields in northern Ohio from 1926 to 1929 indicated that less than 1 per cent. of the total population hibernates in ears harvested from fields with an infestation as high as 2·7 borers per plant and stored in cribs, and that less than 31 adults would emerge from the stored maize from an acre of field with an infestation of 1·4 borers per plant. Where the infestation was 2·7 borers per plant, the number of adults emerging from an acre's yield of stored ears was 72·8 ; where the infestation was 6·4–20·3, the number was 374–1,188. These estimates may be reduced by two-thirds, or doubled, by seasonal fluctuations in the proportion of the total borer populations that remains in the stored ears after harvesting. The smallness of these numbers is due both to extensive migration from the ears before harvest and to high mortality during hibernation.

Insect Pests.—*Bull. Wisconsin Agric. Expt. Sta.*, no. 425 (Ann. Rep. 1931–32), pp. 85–95, 4 figs. Madison, Wis., March 1933.

Experimental work was carried out in Wisconsin by J. H. Lilly and C. L. Fluke to find a satisfactory means of controlling *Coleophora pruniella*, Clem., on apples [*cf. R.A.E.*, A, xx, 293], using " cold-mix " petroleum oil emulsions such as had given good results in treating infested cherries [*cf.* xix, 478]. The formula used was 8 U.S. gals. oil and 1 lb. emulsifier (calcium caseinate) to 92 U.S. gals. water. The mortality obtained ranged from 86·8 to 99·8 per cent., the rate depending on thoroughness of application rather than the characteristics of the various oils. A 20 per cent. kerosene emulsion, however, failed to give control. In one test, substitution of Bordeaux mixture for calcium caseinate reduced the efficiency of the spray. When applied in late autumn instead of early spring, the various oil sprays caused less injury to the trees. No visible injury was caused by spraying in the late dormant stage with 10 per cent. liquid lime-sulphur, containing 2 lb. lead arsenate per 50 U.S. gals., which gave an 84·1 per cent. kill on apple and 86·5 per cent. on cherry. Investigations have shown that case-bearer infestation is usually heaviest in areas where orchards are most numerous, and also near towns and along main roads, the lights of which attract ovipositing females. Various parasites, most of which attack the mature larvae, are gradually becoming important ; in one orchard parasitism in 1932 amounted to 89 per cent., as against 30 per cent. in 1931. At least 24 species of parasites are

known. Of those observed, 68·5 per cent. were *Microbracon pygmaeus*, Prov., and 9·3 per cent. the Pteromalid, *Eurydinota lividicorpus*, Gir. The adults of the Braconid appeared and oviposited in north-eastern Wisconsin towards the end of May. The female paralyses the host larva in its case and then deposits a single egg on its body ; the larva hatches in 3 days, and after feeding on the body fluid of the host, pupates within the case. Under orchard conditions adult emergence lasted from mid-June till 13th July. The Braconid then apparently left the orchards, and though it reappeared in very small numbers in September, it did not then attack the case-bearer. It is not known how it overwinters.

The apple maggot [*Rhagoletis pomonella*, Walsh] was again successfully controlled in 1932 by spraying with lead arsenate against the adults [xix, 478], a second spray being required in the first week of August on account of a large number of flies emerging from two-year-old pupae that had remained in the soil since 1930, probably owing to the extreme drought that prevailed during July and August in 1931.

White grubs [*Lachnosterna* spp.] continued to be very destructive to blue-grass [*Poa*] pastures ; a large number of counts in July 1932 confirmed previous observations [xx, 430, etc.] that the larvae are much less numerous in stands of certain leguminous plants than in pastures of blue-grass. Sweet clover [*Melilotus*], lucerne, and to a less extent red clover [*Trifolium pratense*], when growing in sections where damage by the larvae has been most severe, have invariably shown little or no infestation, and even fields that had only patches of leguminous plants scattered through the blue-grass have escaped injury, as their presence seems to discourage oviposition by the beetles, besides increasing soil fertility. Good, fertile pastures that have not been overgrazed have been relatively free from infestation [*cf.* xx, 125], but applications of commercial fertilisers have been of little value in preventing it. Emergence of the adults, which began on 5th May, reached its maximum in the last week of May, and oviposition began after 15th June. The beetles spent the day in the soil and migrated to trees only after dark, and not unless the temperature was at least 66°F., flying always against the air current and generally towards high ground [*cf.* xvi, 263]. They fed chiefly on the leaves of oaks, and it was possible to kill large numbers by spraying the trees with a mixture of 2 lb. lead arsenate to 50 U.S. gals. water ; in one test, sprayed oaks retained 90 per cent. of their foliage, whereas adjoining untreated ones were entirely defoliated.

Aphids [*Acyrthosiphon onobrychidis*, Boy. (*pisi*, Kalt.)] were again very destructive to peas, and trials to breed resistant strains were conducted by E. M. Searls, based on the observation [xx, 284] that plants with light green foliage were less infested. Peas grown from crosses of three varieties, after being protected from infestation by Aphids in the second generation, were artificially infested in the third generation, when about four inches high, with equal numbers of Aphids ; subsequent counts showed that plants that were light green in colour were invariably much less infested that the dark-coloured ones. The tests also indicated that the relation between colour and infestation is hereditary.

Thrips [*Thrips tabaci*, Lind.] have been the most important insect pests of onions in the south-east ; for their control by sprays, a new type of tractor with narrow wheels, adjustable for varying widths of rows and drawing a sprayer with a capacity of 100 U.S. gallons has recently been tried with success.

MACKIE (D. B.). [Annual Report of the Division of] **Entomology and Pest Control.**—*Mon. Bull. Dept. Agric. Calif.*, xxi, no. 12, pp. 474–488. Sacramento, Calif., December 1932. [Recd. August 1933.]

The weather conditions in California were more favourable in 1932, and the drying up of native vegetation, which led to an unusual migration of insects to cultivated crops in 1931 [*R.A.E.*, A, xx, 584], did not recur. Also, owing to increased subterranean water supplies, fruit trees were more able to resist the attacks of bark-beetles. The fall armyworm [*Laphygma frugiperda*, S. & A.] was completely destroyed by low winter temperature [*cf.* xx, 585]. The bean thrips [*Hercothrips fasciatus*, Perg.] caused considerable injury to peaches in some orchards, the foliage falling prematurely. Infestation of peach fruit by the twig-borer [*Anarsia lineatella*, Zell.], which in 1931 averaged over 10 per cent. for the northern cling-peach belt [xx, 175], dropped to between 2 and 3 per cent. in 1932. Natural control in this year amounted to about 50 per cent. ; eleven species of Hymenopterous parasites were taken, one of which has not previously been recorded from North America. In July, larvae of the codling moth [*Cydia pomonella*, L.] were found for the first time in walnuts in Lake County, the infestation being confined to nuts that were cracked and scorched by the sun.

The serpentine leaf-miner [*Agromyza pusilla*, Mg.] was particularly injurious to peas in 1932, all aerial parts of the plants being severely infested and the loss in individual properties sometimes reaching 90 per cent. In old land where the fly is established, the number of pickings of the pods may be reduced to two, as against fifteen in new land. The onion thrips [*Thrips tabaci*, Lind.] destroyed 33–50 per cent. of the onion crop in the delta region of the Sacramento River. Larvae of the lesser bulb fly [*Eumerus* sp.] were taken in half-grown celery. The alfalfa weevil [*Hypera variabilis*, Hbst.] was recorded from the interior valley counties [xx, 644] ; in other parts of California it has been present for several years, but even where lucerne is extensively cultivated, it has not caused severe damage or spread rapidly. In some districts, considerable injury to lucerne was caused by the pea aphis [*Acyrthosiphon onobrychidis*, Boy. (*pisi*, Kalt.)] and the alfalfa caterpillar [*Colias eurytheme*, Boisd.]. An outbreak of the clear-winged grasshopper [*Camnula pellucida*, Scudd.] occurred in the mountain meadows of two counties.

The elm leaf beetle [*Galerucella luteola*, Müll.] is rapidly spreading, and injury to elms was also caused by the European elm scale [*Gossyparia spuria*, Mod.]. A major infestation by the citrus whitefly [*Dialeurodes citri*, R. & H.] was discovered in Los Angeles County, where six different foci were located ; spraying was started immediately, only the preferred food-plants being treated [*cf.* xx, 173]. In the southern part of the State no third brood emerged on *Citrus*, owing apparently to the cool weather in August, and greatly reduced numbers of the Aleurodids entered hibernation. The grape leafhopper [*Erythroneura comes*, Say] continued to be abundant on vines, *Anagrus epos*, Gir., being too scarce to give effective control of the late summer-brood eggs [*cf.* xxi, 165]. Further surveys of vineyards to determine the status of the raisin moth [*Ephestia figulilella*, Gregson] showed a sharp decline in the numbers feeding on fresh grapes, most of the infestation occurring on mummified fruit [*cf.* xx, 585] ; this Pyralid also attacked harvested figs on the drying trays and in storage, reaching the status of a major pest.

Tests conducted in view of the heavy infestation of stored grain in 1931 [xx, 586] by the granary weevil [*Calandra granaria*, L.] showed

successful fumigation with hydrocyanic acid gas to be difficult in rural warehouses when filled with sacks of grain. Very satisfactory results were obtained in destroying weevils in empty warehouses by the application with orchard sprayers of cheap dormant spray oils at a concentration of 3 per cent. The use of 70 per cent. sodium fluosilicate, dusted over the sacks or used as a barrier, proved of value in preventing the weevils from migrating to new grain. The Australian grain-borer [? *Ptinus tectus*, Boield.], which has not previously been recorded from California, was found well established in a grain elevator, infesting the grain and riddling the timber of which the elevator was constructed; large numbers were destroyed by an oil emulsion spray with the addition of 1 per cent. creosote, which caused the beetles to leave their burrows.

FLEURY (A. C.). [Annual Report of the] **Division of Quarantine Administration.**—*Mon. Bull. Dept. Agric. Calif.*, xxi, no. 12, pp. 540–555. Sacramento, Calif., December 1932. [Recd. August 1933.]

In addition to some of the pests mentioned in previous reports [*R.A.E.*, A, xix, 690; xx, 586], the following species were intercepted in California during 1932: *Dacus* (*Bactrocera*) *cucurbitae*, Coq., in watermelons, and *Cryptorrhynchus* (*Sternochetus*) *mangiferae*, F., in mango seed, from Hawaii; *Popillia japonica*, Newm., in the soil about the roots of a flowering cherry from Japan; *Rhagoletis pomonella*, Walsh, and *Conotrachelus nenuphar*, Hbst., in apples from New Jersey and Minnesota respectively; the weevil, *Euscepes batatae*, Waterh., in sweet potatoes, and *Prays citri*, Mill., in sour limes, from the Philippines; *Acronycta rumicis*, L., on rose stock from France; the chestnut weevil, *Curculio proboscideus*, F., in chinquapins [*Castanea pumila*] from North Carolina; a mealybug, *Trionymus* sp., not known to occur in California, on cactus from Porto Rico; and *Prontaspis citri*, Comst., and *Pseudaonidia duplex*, Ckll., from Japan, and *Selenaspidus articulatus*, Morg., from Panama, Porto Rico and Texas, all on fruits of *Citrus*.

NELSON (E. M.), HURD-KARRER (A. M.) & ROBINSON (W. O.). **Selenium as an Insecticide.**—*Science*, lxxviii, no. 2015, p. 124. New York, 11th August 1933.

This is a warning against the use of selenium as an insecticide. At the rate of 15 parts per million or even less in the soil, when added as sodium selenate, it produces distinct chlorosis and stunting of wheat. Quantities as small as 1 part per million permit growth and maturation with no visible symptoms of injury to the plant, but when the grain or straw is fed to rats or guineapigs, it produces a pronounced retardation in growth, followed by death after a few weeks. Wheat that has been found by analysis to contain 8–10 parts per million of selenium absorbed from the soil produces fatal injury. Since it can be assimilated from the soil by at least some and possibly all plants, even the complete removal of spray residue from an edible product might be no safeguard, and the degree of toxicity of the compound used in spraying a plant is not a measure of the toxicity of the compounds formed in the plant. Moreover, there is evidence that selenium compounds may be reduced

by soil organisms, so that spray residues ordinarily considered innocuous may be made available to the plant and be converted into highly toxic combinations.

SUMNER (R.). **Influence of Gregarines on Growth in the Mealworm.**—*Science*, lxxviii, no. 2015, p. 125. New York, 11th August 1933.

Larvae of *Tenebrio molitor*, L., from eggs kept in sterilised food in a petri dish did not develop as rapidly, nor become as large, as those from eggs remaining in the culture with adults, and the rate of mortality was higher. Since Gregarines were always found in the latter and never in the former, they are apparently essential for growth. It was not ascertained whether or not they play a part in digestive processes.

PREBBLE (M. L.). **The Biology of *Podisus serieventris* Uhler, in Cape Breton, Nova Scotia.**—*Canad. J. Res.*, ix, no. 1, pp. 1–30, 16 figs., 24 refs. Ottawa, July 1933.

The following is almost entirely taken from the author's abstract :—
The biology of the predacious Pentatomid, *Podisus serieventris*, Uhl., and its rôle in an outbreak in Cape Breton, Nova Scotia, of *Peronea variana*, Fern. (black-headed budworm) on conifers [*cf. R.A.E.*, A, xxi, 227] are described from studies carried on in 1930 and 1931. There is only one complete generation of the predator a year, and adults of both sexes hibernate. The eggs are laid from late June to August, the incubation period being 10–15 days. There are 5 nymphal instars, with an average total of 45 days. In Massachusetts, on the other hand, 4 nymphal instars, 3 annual generations and the hibernation of females only were reported by Kirkland in 1897. The species conforms satisfactorily to Dyar's Law [*cf.* xx, 579], the average growth ratio of the head-capsules of individuals studied in 1931 being about 1·28. The first-instar nymphs fed on unhatched eggs of their own species and the juices of coniferous and deciduous foliage, but rejected small larvae of *Peronea*. Nymphs fed on a purely vegetable diet were able to complete the first instar, but died before the second moult. Older nymphs, fed for some time on animal food, were not able to reach maturity on plant food alone. The food consumption of the various instars is briefly summarised. Evidence is presented which suggests that the predator uses a toxic secretion in overcoming its prey.

A list is given, from the literature and from observation, of the insects on which this bug is predacious. Its rather limited value as a control factor in the outbreak of *Peronea* in 1930 and 1931 is described. The decline of the population of the moth in 1931 caused a corresponding mortality by starvation of the bugs.

JACKSON (T. P.). **Work connected with Insect and Fungus Pests and their Control.**—*Rep. Agric. Dept. St. Vincent 1932*, pp. 9–14. Trinidad, 1933.

In 1932, cotton in St. Vincent was attacked by *Platyedra gossypiella*, Saund., which first appeared 153 days after the crop was planted [*cf. R.A.E.*, A, xx, 611], and did not cause serious damage, and *Dysdercus discolor*, Wlk. (*delauneyi*, Leth.), which was not numerous. *Alabama argillacea*, Hb., was not observed until early in 1933, when it was

effectively controlled by lead arsenate or Paris green. Serious outbreaks of *Calpodes ethlius*, Cram., occurred on arrowroot in June and July. *Gryllotalpa* sp. continued to cause considerable loss to tomatos, sometimes destroying 50–75 per cent. of young plants; and since poison baits (containing Paris green or lead arsenate) failed to give effective control, attempts were made to find some means of protecting the young plants in the soil. Encircling them with tin collars, set about 4 ins. deep with 2 ins. projecting above the soil, was quite ineffective, as the crickets apparently entered the enclosed spaces below the tin and cut down all the plants. Excellent results, however, were obtained by wrapping round each seedling before planting one large leaf of *Mammea americana*, of which one inch was left above the soil surface; of eighteen plants thus protected, only four were cut down, and in another experiment all remained untouched. It is possible that these leaves act as a repellent.

PICKLES (A.). **Entomological Contributions to the Study of the Sugar-cane Froghopper.**—*Trop. Agriculture*, x, no. 8, pp. 222–233, 8 graphs, 11 refs. Trinidad, August 1933.

Investigations in Trinidad on the natural enemies of *Tomaspis saccharina*, Dist., on sugar-cane [*R.A.E.*, A, xx, 545] were continued in 1932. The chief egg-parasite is the Mymarid, *Anagrus urichi*, Pickles, other species apparently being of only occasional occurrence. Repeated attempts to breed it in captivity have so far been unsuccessful; its life-cycle is probably longer than that of the host, as it has been seen to emerge from cultures of eggs 10–12 weeks after they have been taken from the field. It is almost entirely inactive during the dry season; in wet years, it becomes generally distributed and relatively abundant as early as May–June, whereas a prolonged and severe dry season, which is generally followed by a serious outbreak of the froghopper, may reduce the numbers of the parasite to a negligible quantity till October–November. Parasitism was markedly higher in host eggs from the cane trash than in those laid in the soil around the stools, where though they are usually more abundant [xx, 94], they are relatively inaccessible to attack.

Special attention has been devoted to the study of the predacious Syrphid, *Salpingogaster nigra*, Schin. [ix, 262]. In weekly counts of ten stools in each of several selected areas, it was found that a certain number invariably harboured froghopper nymphs but no larvae of the Syrphid, whereas others, not necessarily the most heavily infested, contained several of the predators. This indicates that the Syrphid eggs are laid at random, so that the mortality actually caused by it is less than would occur if the larvae were evenly distributed amongst the infested stools. The value of the predator is also decreased by the fact that under ordinary cane-field conditions the larvae seem to be unable to move from one stool to another, or survive outside the interior of a spittle mass. To a certain extent they are attacked by internal parasites, and where several are present in one stool that contains but few froghopper nymphs, probably one larva only will survive, the others dying from starvation or cannibalism. *S. nigra* is adversely affected by severe dry-season conditions, which delay its appearance in quantity in the fields, but under favourable conditions it may give a degree of control estimated at about 20 to 40 per cent., on the assumption that one larva may destroy in the course of its development up to 40 nymphs

[ii, 96]. The problem of artificial breeding [ii, 463] presents many difficulties.

The green muscardine fungus, *Metarrhizium anisopliae*, is the most important natural factor in the control of the froghopper ; detailed evidence is given showing that it can reduce a potentially large population below the level at which serious damage occurs. A certain degree of humidity is essential for its growth, and dry weather in the early part of the year delays its appearance in the normal wet season until much damage has already been done by the froghoppers. This explains the periodical occurrence of outbreaks following a severe, dry season, which also affects adversely the egg-parasites and predators. It is suggested, therefore, that the observed four or five years' interval between outbreaks is ultimately due to a weather cycle.

MUNGOMERY (R. W.) & BELL (A. F.). **Fiji Disease of Sugar-cane and its Transmission.**—*Bull. Div. Path. Bur. Sug. Expt. Sta. Queensland*, no. 4, 28 pp., 8 figs., 19 refs. Brisbane, 1933.

Experiments are described on the transmission of Fiji disease of sugar-cane in Queensland, where it is established in several localities. It also occurs in New South Wales, Fiji, New Guinea (from which it probably originated) and the Philippines. The symptoms include stunting, distortion of the leaves and the formation of characteristic pale green or yellow galls on the lower surface. Diseased plants are never known to recover, and in the absence of control measures 100 per cent. loss normally results. Attempts to transmit the virus by mechanical means were unsuccessful. As a result of preliminary tests with various insects to discover possible vectors, attention was concentrated on *Aphis sacchari*, Zehnt., *Trionymus sacchari*, Ckll., and *Perkinsiella saccharicida*, Kirk. [*cf. R.A.E.*, A, xx, 187]. In experiments with these, the disease was transmitted only by nymphs of *P. saccharicida*, though it is possible that infected nymphs retain their infectivity in the adult stage. A description is given of this Delphacid, with notes on its bionomics [*cf.* viii, 19, etc.] and natural enemies. Of these the commonest are the Capsid, *Cyrtorhinus mundulus*, Bredd. [viii, 525], the Mymarid, *Paranagrus optabilis*, Perk., and the Eulophid, *Ootetrastichus beatus*, Perk., all of which attack the eggs.

Symptoms of the disease usually become apparent in December–April ; during the drier, colder months (May–August) there is little visible spread of the infection. Secondary spread and infestation by the leafhoppers are always greater where the cane is growing vigorously. After the liberation of infected nymphs in mid or late summer, the period of latency before the appearance of symptoms ranged from 7 to 16 weeks, being most often 8–9 ; when feeding did not begin till late autumn or early winter, it was 6–7 months. For general control purposes, roguing should be carried out not only in spring, when the leafhoppers are scarcest, but at regular intervals as long as practicable. Fields in which any infection appears after February should not be used as sources of plants, owing to the difficulty of recognising infection in apparently healthy plants during the long winter period of latency. Where the leafhoppers are present, diseased stools should be sprayed with an insecticide before uprooting. No immune variety of cane was discovered, but POJ 2714 was especially susceptible.

Observations in Fiji suggest that the vector there is *Perkinsiella vitiensis*, Kirk.

Davidson (J.). **The Distribution of *Sminthurus viridis* L. (Collembola) in South Australia, based on Rainfall, Evaporation and Temperature.**—*Aust. J. Exp. Biol. Med. Sci.*, xi, pt. 2, pp. 61–66, 2 graphs, 2 maps, 7 refs. Adelaide, 16th June 1933.

The geographical distribution of *Smynthurus viridis*, L., in South Australia [*cf. R.A.E.*, A, xxi, 406, etc.] is determined by the ratio of mean monthly rainfall to evaporation, the latter being estimated by saturation deficiency. When the ratio is less than 1 (November–March), dryness may prevent the occurrence of the active stage of the insect ; when it greatly exceeds 1, as may happen in April–October, excessive wetness, particularly when accompanied by a mean monthly temperature below 52°F., severely restricts its increase in numbers, owing to retarded development and high death rate. A map is given showing approximate areas in South Australia in which rainfall exceeds evaporation in different months, and on this basis an attempt is made to establish the probable limits of distribution of the springtail.

Meyrick (E.). **Exotic Microlepidoptera, iv, pt. 13.**—pp. 385–416. Marlborough, Wilts, the author, August 1933. Price 3*s*. per pt.

Among the new species described are the Pyralids, *Salebria cirrhodelta*, bred from a larva feeding on grain of *Sesamum indicum*, and *Philotroctis* (gen. n.) *eutraphera*, from larvae feeding in fruit of *Mangifera*, both in Java, and *Cateremna pinivora*, from larvae feeding on needles of *Pinus excelsa* in Kashmir, and the Tineid, *Trachycentra elaeotropha*, bred from fruits of oil palm (*Elaeis*) in Java.

Du Pasquier (R.). **Principales maladies parasitaires du théier et du caféier en Extrême-Orient.**—*Bull. écon. Indochine*, xxxvi, pp. 1–144, 24 figs., 5 pls., many refs. Hanoi, 1933.

The bulk of this fifth and last paper of a series [*R.A.E.*, A, xxi, 259, etc.] deals with the fungi and other plant parasites attacking tea or coffee in Indo-China and other countries in the Far East. The relative importance of these and of the animal pests is discussed, and the incidence of the various pests in the different months in Tonkin is shown in tables. Notes are given on the preparation and packing of specimens, and one chapter (pp. 107–123) is devoted to the preparation and uses of various insecticides and fungicides. Official regulations regarding the use of toxic substances in Indo-China are summarised. Keys to the pests of tea and coffee, based partly on the types of injury caused, are appended.

Note sur la propriété insecticide des racines de derris.—*Bull. écon. Indochine*, xxxvi, pp. 195–204, 1 fig., 61 refs. Hanoi, 1933.

Though a number of species of *Derris* occur in Indo-China, their insecticidal properties are locally practically unknown. Information is therefore given, based on the literature, on the species containing the active principle and its properties, as well as on the cultivation of the plant, the preparation of insecticides from it and their value.

Braun (K.). *Acocanthera*-**Arten as Giftpflanzen.** [Species of *Acocanthera* as Poison Plants.]—*Das Hochland*, iii, no.8–9, reprint 24 pp., 3 figs., 98 refs. Mombo, Tanganyika [? 1933]. (Reproduced from *Z. angew. Bot.*).

Braun (K.). *Tephrosia vogelii* **Hook f. als Fischgiftpflanze im früheren Deutsch-Ostafrika.** [*T. vogeli* as a Fish-Poison Plant in Tanganyika.]—*Angew. Botanik*, xv, no. 3, pp. 253–261, 1 fig., 39 refs. Berlin, 1933.

In view of the success of preparations of derris as insecticides, the author summarises all available information on the use by the natives of Tanganyika Territory of the various species of *Acocanthera* as arrow-poisons and of *Tephrosia vogeli* as a fish-poison. Lists of the native names of these plants are included.

Jack (R. W.). **Report of the Chief Entomologist for the Year 1932. Agricultural.**—*Rhod. Agric. J.*, xxx, no. 7, pp. 564–569. Salisbury, S. Rhodesia, July 1933.

The pests recorded in Southern Rhodesia in 1931–32, many of which have already been noticed [*R.A.E.*, A, xx, 190, 499, 555 ; xxi, 61], included the weevil, *Tanymecus destructor*, Mshl., and larvae of the Melolonthid, *Eulepida mashona*, Arrow, on maize ; the mite, *Halotydaeus* (*Penthaleus*) *destructor*, Tuck., which was locally injurious to late-sown winter wheat in August ; *Myzus persicae*, Sulz., and *Euxoa segetum*, Schiff., on tobacco ; and *Heliothis obsoleta*, F., and the stainers, *Dysdercus nigrofasciatus*, Stål, *D. intermedius*, Dist., and *Oxycarenus* sp., on cotton. *H. obsoleta* was also unusually abundant on *Citrus*. A list of new or noteworthy pests includes : *Lygaeus militaris*, F., on ripening peaches ; *Anomala* spp., *Adoretus* spp., and *Pachnoda* spp., on the leaves and fruit of deciduous fruit trees ; the Aphid, *Macrosiphoniella sanborni*, Gill, on chrysanthemums ; the Coccids, *Ceroplastes helichrysi* var. *sinoiae*, Hall, on young jacaranda trees, *Eriococcus araucariae*, Mask., on Norfolk Island pine [*Araucaria excelsa*], and *Inglisia geranii*, Brain, on geranium ; the Chloropid, *Epimadiza hirta*, Mall., which was abundant in three localities in stems of *Gladiolus* ; the Lamiid, *Tragicoschema* (*Tragocephala*) *wahlbergi*, Fhs., boring in *Hibiscus* ; *Apate monacha*, F., the adults of which were boring in ornamental and fruit trees in October, being particularly injurious in *Trichilia emetica* ; *Dasus* (*Gonocephalum*) *simplex*, F., on seedling wheat and barley ; and *Parasa vivida*, Wlk., which did some damage to coffee, but was largely controlled by its Braconid parasite, *Fornicia africana*, Wlkn. [xix, 26].

Smith (A. J.). **Report on Cotton Insect and Disease Investigations. Part 3. Notes on the Red Bollworm** (*Diparopsis castanea* **Hampson**) **of Cotton in South Africa.**—*Sci. Bull. Dept. Agric. S. Afr.*, no. 114, 29 pp., 3 graphs, 1 pl. Pretoria, 1933. Price 3*d*.

An account is given of observations carried out in the field and the laboratory in the Transvaal from 1924 until about the middle of 1931 on the bionomics of *Diparopsis castanea*, Hmps. (red bollworm), which occurs in practically all the cotton-growing areas of South Africa. The stages are described. The eggs are laid on any part of the plant

[*R.A.E.*, A, xix, 165], particularly on the upper half, and hatch in 3–10 days. The larvae immediately start seeking food and bore into the young bolls, or preferably the squares or flowers, usually entering under the bracts. When only 1–2 locules are destroyed, the bolls are still able to mature. Occasionally, in the absence of these fruiting parts, the larvae may bore into the stem, but it is doubtful whether they are able to complete their development there. The damage may be distinguished from that caused by *Heliothis obsoleta*, F. (American bollworm), as the interior of the boll is discoloured and filled with excreta and all the locules are usually destroyed. The length of the larval stage varies considerably, being 11–35 days in the insectary and 18–48 in cages in the field The full-grown larvae enter the soil, usually to a depth of about 3 ins., for pupation, which takes place after 6–8 days. Moths are able to emerge from as deep as 9 ins., and it would thus appear that few, if any, are prevented from emerging by burying the pupae deeply by ploughing [*cf.* xx, 242]. Of those that pupated in the first half of March 1927, 78·5 per cent. emerged during the same season, and the remainder, together with all those that pupated during the second half of March, emerged in the course of the following 3 seasons [*cf.* xvi, 304]. It appears that the pupal period is prolonged when the pupae are not subjected to rain and the direct rays of the sun; the hibernating pupae, however, appear to be less affected by climatic conditions. The life-cycle from egg to adult occupied at least 39 days in the insectary, but under natural conditions it probably approximates to 46. The normal breeding season probably lasts from the beginning of November to about the middle of August, so that 3 generations may develop. There is apparently a steady annual increase in infestation until the peak is reached in March, after which the numbers decrease with the advent of cold weather. Moths in a field-cage lived as long as 22 days, and fertilised females laid as many as 487 eggs, many still containing fully developed eggs after death. The moths are fairly strong fliers and are active at night.

Although the damage caused to cotton, particularly to the young plants, may be severe, no instance of total destruction of the crop by this species alone has been recorded in the area in which these investigations were carried out. A larva of *H. obsoleta* is responsible for at least 3 times as much damage as one of *D. castanea.* In the season 1930–31, at least 37·3 per cent. of the total number of squares and bolls shed were due to damage by bollworms, causing an estimated loss in crop of 33·7 per cent., 19·9 per cent. of which was due to *D. castanea.* Though this figure is probably under the average, owing to a comparatively light infestation in that season, it shows that undue importance is sometimes attached to such losses, other factors, such as shedding owing to natural conditions, unfavourable weather or the depredations of other insects, often being overlooked.

Natural enemies of *D. castanea* include *Trichogramma lutea*, Gir., *Apanteles diparopsidis*, Lyle, which was quite common, especially late in the season, the predacious wasp, *Synagris mirabilis*, Guér., the Pentatomid, *Glypsus conspicuus*, Westw., and the Asilid, *Alcimus tristrigatus*, Lw., none of which appears to exercise any appreciable degree of control.

Various control measures tested are briefly discussed, but few appeared to be of any value. If, after the last picking, the cotton stalks are found to have many infested bolls, they should be cut and burnt, but if they are free from bolls, they may be safely ploughed

under. Rows of cotton plants left standing as traps may be attacked by the moths that emerge before the newly planted cotton has grown sufficiently to be attractive, and most of the early brood may be destroyed by stripping the trap plants and ploughing them under. As the adults may oviposit on small plants of cotton having few leaves, the main crop should be planted as late as possible, to give the trap rows the longest possible period over which to function. The degree of control effected by this measure is, however, problematical.

CHIAROMONTE (A.). **Aspetti entomologici della coltura del Caffè nella Colonia Eritrea.** [The Entomological Aspects of Coffee Cultivation in the Colony of Eritrea.]—*Agric. colon.*, xxvii, no. 7, pp. 320–323. Florence, July 1933.

In Eritrea coffee is the crop next in importance to *Sorghum* and cotton. It is attacked by the Bostrychid, *Apate monacha*, F., which bores in the stems and older branches, sometimes killing the plant, *Coccus* (*Lecanium*) *viridis*, Green, which infests the young twigs and leaves, and the Pyralid, *Thliptoceras octoguttale*, Feld., the larvae of which feed on the tender seeds in the green berries.

MORRIS (H. M.). **Annual Report of the Entomologist for the Year 1932.**—*Ann. Rep. Dept. Agric. Cyprus 1932*, pp. 39–43. Nicosia, 1933.

Notes are given on a number of pests observed in Cyprus during 1932, some of which have already been recorded [*R.A.E.*, A, xx, 581, etc.]. The Cetoniids, *Epicometis hirta*, Poda, and *Oxythyrea abigail*, Reiche & Saulcy, were abundant in spring all over the Island, attacking cultivated flowers, young wheat ears, and young and soft almonds. They had probably migrated to cultivated plants owing to a scarcity of wild flowers, due to an unusually dry season. The Cistelid, *Omophlus propagatus*, Kirsch, caused serious damage to vine flowers in the beginning of May, and *Theresia* (*Zygaena*) *ampelophaga*, Bayle, also attacked vines early in the season. Cecidomyiid larvae were found in galls on vines, but the galls were only injurious when they occurred on the flower-stems. Potatoes were infested in autumn by *Laphygma exigua*, Hb. Experiments on *Platyedra gossypiella*, Saund., showed that early maturity of cotton is desirable to enable the crop to be picked before the occurrence of the severe attack that develops late in the season.

MARTELLI (G. M.). **Danni del** *Tapinoma nigerrimum* **Nyl. alle parti aeree di alcune piante del genere** *Citrus*. [Injuries by *T. erraticum nigerrimum* to the aerial Parts of some Plants of the Genus *Citrus*.]—*Riv. Pat. veg.*, xxiii, no. 7–8, reprint 7 pp., 3 figs. Pavia, 1933.

In the spring of 1933, several species of *Citrus* in Sicily were attacked by *Tapinoma erraticum nigerrimum*, Nyl. The ants removed small pieces of the bark of tender twigs, feeding on the gummy, slightly sweet exudate. The twigs fell to the ground or bent over at the weakened points and withered. In some cases, especially on a variety of bitter orange, more serious harm was done by feeding on the inflorescences. Good results were obtained with adhesive bands, placed on the trunks and changed every 6–7 days.

Rui (D. B.). **Ulteriori prove di lotta invernale contro la tignola del melo.** [Further Experiments in Winter Work against the Apple Moth.]—*Note Fruttic.*, xi, no. 8, pp. 140–149, 1 fig., 3 refs. Pistoia, August 1933.

In previous experiments in Venetia, the results of winter spraying with a tar distillate against the apple race of *Hyponomeuta padellus*, L. (*malinellus*, Zell.) did not appear to justify the cost [*R.A.E.*, A, xx, 478]. Further tests of the same spray, however, made in view of Malenotti's observation of the delayed action of such insecticides on this Tineid [xxi, 37] showed that though its immediate effect was slight, the ultimate result was satisfactory, the trees being almost entirely freed from infestation.

Jancke (O.). **Gespinstmotten als Grosschädlinge an Obstbäumen.** [Ermine Moths as large-scale Pests of Fruit-trees.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 4, pp. 431–441, 5 figs., 19 refs. Berlin, May 1933.

The geographical distribution of the ermine moths (*Hyponomeuta*) infesting apple and plum is reviewed, with records of their occurrence as pests in Russia, Sweden and Germany. In 1932 they were abundant in central Germany, particularly in one district in which plum trees were defoliated with a resultant loss in weight of the crops estimated in June at about 35 per cent., apples being much less severely infested. The author believes that *H. malinellus*, Zell., on apple is a biological race of *H. padellus*, L., on plum, etc. [*cf. R.A.E.*, A, xviii, 692, etc.]. The adults are indistinguishable, but in experiments those of the apple race refused to oviposit on plum. In summer the larvae may be destroyed by arsenical or contact sprays. The application, when the moths were ovipositing, of poison-bait sprays containing sodium fluoride (0·4 per cent.) or derris (1 per cent.) with 3 per cent. sugar produced a mortality of 80–85 per cent. An 8–10 per cent. tar distillate spray gave almost complete control of young larvae in hibernation in the spring of 1932.

Jancke (O.) & Böhmel (W.). **Beitrag zur Biologie und Bekämpfung der Kirschfliege.** [On the Biology and Control of the Cherry Fly.] —*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 4, pp. 443–456, 1 fig., 15 refs. Berlin, May 1933.

An account is given of observations on *Rhagoletis cerasi*, L., in central Germany from 1930 to 1932. In 1932 the adults emerged over a period of about 2½ weeks, beginning on 1st June from the soil under sweet cherry trees, and about a week earlier under *Lonicera tatarica* [*cf. R.A.E.*, A, xxi, 375]. The first adults of *R. meigeni*, Lw. (barberry fly) appeared on 5th June. *R. cerasi* required at least 8 days to mature its eggs; the maximum number of mature eggs in a female was 42. A maximum longevity of 77 days was observed; in favourable circumstances the flight-period could therefore extend from early June to mid-August. In experiments to ascertain the reaction of *R. cerasi* to various stimuli, the flies showed marked negative geotropism. Since they were indifferent to odours, the addition of sweeteners to poison bait-sprays did not attract them, but it did cause them to ingest a larger quantity of poison, besides increasing the adhesiveness of the spray. Observation of the date of adult emergence, which is important for control, is best made by laying frames covered with wire-gauze on

the ground under the trees. In tests on sour cherry, the most effective bait-spray was one containing 0·4 per cent. sodium fluoride with the addition of sugar or molasses ; other satisfactory sprays were 0·4 per cent. derris extract with molasses, or 0·2 per cent. with sugar.

KAUFMANN (O.). **Der glanzstreifige Schildkäfer** (*Cassida nobilis* **L.**) **nebst einigen Bemerkungen über den nebligen Schildkäfer** (*Cassida nebulosa* **L.**). [*C. nobilis*, with some Observations on *C. nebulosa*.]—*Arb. biol. Reichsanst. Land- u. Forstw.*, xx, no. 4, pp. 457–516, 41 figs., 33 refs. Berlin, May 1933.

Since about 1929, Cassidid beetles have become increasingly abundant in Germany, especially in Silesia. *Cassida nebulosa*, L., has been held responsible for the injury to beet, the smaller *C. nobilis*, L., being rarely mentioned, and the infestation has been ascribed to the presence in or near beet-fields of chenopodiaceous weeds, which were considered to be the original food-plants [*cf. R.A.E.*, A, xi, 159 ; xix, 185]. Both these assumptions, however, seem disproved by the investigations in Silesia here discussed.

A detailed account is given of the observations on the bionomics and parasites of *C. nobilis*, and the morphology of all stages is described. The eggs were laid singly, preferably on sugar-beat and to a less extent on *Atriplex* and *Chenopodium*, which do not affect the degree of infestation by this species. Oviposition lasted 2 months, beginning in late April or May. The maximum number of eggs laid by a female in a month was 106. The young larvae fed at once, the injury resembling that by *C. nebulosa*. The larvae were very sensitive to moisture of any kind, and rain washed them off the leaves, causing them to adhere to particles of soil and die. Heavy rain can thus terminate a severe infestation. Temperature governed the duration of larval and pupal development ; its effect is shown in a series of curves. Pupation took place on the leaf-stems or the lower surface of the leaves. In 1932 in the field, the first adults were observed 66 days after the first eggs. The beetles continued to feed until August, when they entered hibernation, which lasted for 8 months. Feeding was most intense in spring with the onset of sexual activity. There was thus only 1 generation a year.

The Eulophid, *Tetrastichus bruzzonis*, Masi, was the most important parasite of *C. nobilis*, 50 per cent. parasitism being observed. It oviposited in larvae in all instars, and, exceptionally, in the pupae. It developed more rapidly than *C. nobilis* ; 3 generations were obtained in the laboratory, and 2 probably occur in nature. The ratio of males to females was 1 : 3, and parthenogenesis occurred, producing males only. *T. bruzzonis* also parasitised *C. nebulosa*, *C. rubiginosa*, Müll., and *C. vibex*, L. The possibility of breeding it artificially on the larvae of *C. nebulosa* is discussed. Another Hymenopterous parasite, provisionally identified as a Pteromalid, *Habrocytus* sp., was also observed, but was of negligible importance. A Tachinid, *Pseudoptilops nitida*, Röd., oviposited on the old larvae of *C. nobilis*, and the parasite larvae continued to infest them in the pupal and adult stages and destroyed their reproductive organs. After overwintering in its host, the Tachinid larva came out to pupate 1–2 weeks after the emergence of the latter from hibernation in late April. Parasitised beetles soon died. The pupal stage of the Tachinid in nature probably lasts 3–4 weeks, the adults emerging at the end of May or in June, when host larvae are available for oviposition. All stages are described. It was found parasitising about 13 per cent. of the third and fourth instar

larvae of *C. nobilis* observed in late June, and a higher percentage (up to 40) of the adults from July onwards. It was also occasionally reared from *C. vittata*, Vill.

C. nebulosa laid its eggs in batches, preferably on *Chenopodium album*. No eggs were laid on beet, and the larvae fed on beet only if compelled. Two generations were bred in the laboratory and probably occur in nature. *T. bruzzonnis* was the only parasite observed ; others are recorded from the literature.

BRAUN (K.). **Tätigkeitsbericht der Biologischen Reichsanstalt für Land- und Forstwirtschaft, Zweigstelle Stade . . . vom 1. April 1932 bis 31. März 1933.** [Report from 1st April 1932 to 31st March 1933 of the Stade Branch of the Imperial Biological Institute for Agriculture and Forestry.]—*Altländer Ztg.*, 1933, nos. 94, 98, 102, 106, 110, 114, reprint 7 pp. Jork, 1933.

Studies of *Psylla mali*, Schm., on apple in the Lower Elbe district were practically limited to statistical observations. Further observations on the dates of adult emergence in the laboratory of *Cheimatobia brumata*, L. [*R.A.E.*, A, xx, 615] appeared to justify the view that biological races occur, emergence ceasing earlier for strains from greater altitudes or wetter districts. In breeding experiments the proportion of males to females was 2 : 3 ; it is suggested that the predominance of males in catches in nature is due to the longer time required by the wingless females to reach the tree trunks, making possible a greater mortality on the way. Nearly all adults were able to survive a temperature of −8·9°C. [15·98°F.], but −20°C. [−4°F.] was always fatal. *C. brumata* defoliated fruit trees and also occurred on oaks and hedge plants (lime, etc.) in several localities, but the larvae were almost all destroyed by Tachinid and Hymenopterous parasites and diseases caused by bacteria and fungi. Tar distillates of 5 per cent. strength destroyed the eggs of *P. mali*, but 10 per cent. was necessary to reduce infestation by *C. brumata*.

Anthonomus pomorum, L., caused definite injury to apple when, as often occurred, all the blossoms in a cluster were infested [*cf.* xx, 658, etc.]. In experiments with trap-bands of corrugated cardboard on apple trunks larger catches of this weevil and of *Cydia pomonella*, L., were obtained if the card was in direct contact with the bark and not separated from it by parchment paper.

BERAN (F.). **Blausäurebegasung von Obst.** [The Fumigation of Fruit with Hydrocyanic Acid Gas.]—*Neuheiten PflSch.*, xxvi, no. 4, pp. 73–79, 7 refs. Vienna, August 1933.

Fumigation with hydrocyanic acid gas being the most reliable measure against *Aspidiotus perniciosus*, Comst., an investigation was made in Austria with harvested apples and pears to ascertain whether they can absorb the gas and retain it for a long period and whether they are injured by the treatment. It was found that fruit fumigated with Zyklon B or pure HCN absorbed a small amount of the gas superficially, but it disappeared after 3 hours. The traceable amount depended only slightly on the concentration of the gas and the duration of its application. No danger to health is to be apprehended. A dosage of 0·5 volume per cent. HCN acting for 1–2 hours, which suffices for practical control, did not injure the fruits, but some spotting of the skins was apparent after 3 hours. A 1 per cent. concentration was injurious

within 1 hour. Zyklon B was more harmful in 6 hours than pure hydrocyanic acid gas at the same strength in 24, so that the method of producing the gas from calcium cyanide is preferable for plant protection (*e.g.*, in tree fumigation) to the Zyklon method.

CREBERT (H.). **Beobachtungen über den Befall der Pferdebohne mit Bohnenkäfer.** [Observations on the Infestation of Horse beans by Bean Beetles.]—*Fortschr. Landw.*, vii, pp. 487–490, 3 figs., 1932. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 4, p. 83. Vienna, August 1933.)

Horse beans have been attacked severely by *Bruchus rufimanus*, Boh., at Freising, Bavaria. The eggs were laid at random, preferably on the early pods ; as many as 44 were observed on a single pod. Oviposition occurred less readily on varieties with hairy pods. The larvae ate through the pod-walls and then worked between the seed-envelope and the cotyledon, reducing the value of the seed-crop [*cf. R.A.E.*, A, xix, 589]. In greenhouses the adults began emerging on 10th August ; emergence occurred later in the field. The number emerging was about 12 per cent. of that of the eggs laid on the pods, small pods yielding one each, and large pods 3–5. The beetles hibernated in the ground.

SCHRÖDER (E.). **Ein Blasenfuss im Frühkohl.** [A Thrips in an early Variety of Cabbage.]—*Obst- u. Gemüsebau*, lxx, pp. 27–28, 1 fig., 1932. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 4, p. 84. Vienna, August 1933.)

An infestation of early cabbage in northern Germany by *Thrips angusticeps*, Uzel, affected about 5 acres. By night, or in cold, wet weather, the thrips sheltered between the heart-leaves, but in fairly fine weather or in sunshine they migrated to the upper leaf-surface before 11 a.m. The application after this hour of a spray containing 2 per cent. tobacco and 0·75 per cent. soft soap gave good results.

ESCHERICH (K.). **Das Vorkommen forstschädlicher Insekten in Bayern.** [The Occurrence in Bavaria of Insects injurious to Forests.]—*Forstwiss. Zbl.*, liv, pp. 299–309, 317–332, 11 figs., 1932. (Abstr. in *Neuheiten PflSch.*, xxvi, no. 4, p. 86. Vienna, August 1933.)

The pests recorded include : the weevil. *Magdalis frontalis*, Gyll., doing serious damage to pine seedlings ; the Chrysomelid, *Melasoma aenea*, L., and the Galerucid, *Agelastica alni*, L., which severely injured the foliage of black alder [*Alnus glutinosa*] in two localities ; the Geometrid, *Phigalia pedaria*, F., on various deciduous trees, this being its first appearance as a forest pest in Germany ; *Diprion* (*Lophyrus*) *sertifer*, Geoffr. (*rufus*, Retz.) attacking *Pinus banksiana* ; and *Cryptococcus* (*Coccus*) *fagi*, Bär., which severely injured beech in the Palatinate, 15–20 per cent. of the infested trees dying.

MARCUS (B. A.). **Die Entwicklung der Forleule** (*Panolis flammea* **Schiff.**) **1931 im Lorenzer Reichswald.** [The Development of the Pine Noctuid, *P. flammea*, in 1931 in the Lorenzer State Forest.]—*Z. angew. Ent.*, xx, no. 2, pp. 169–203, 5 figs., 23 refs. Berlin, July 1933.

In 1931 the anticipation of a serious outbreak of *Panolis flammea*, Schiff., in the Lorenzer pine forest near Nuremburg led to dusting with

arsenical and contact insecticides early in June, aeroplanes and power dusters being employed. At the end of June, however, practically all the larvae, even in undusted stands, died suddenly, chiefly through the agency of *Empusa aulicae*. This paper deals with investigations on the biology of the moth made in the spring. The technique is described, and the data obtained are summarised in graphs. In mid-April, pupae were placed in bottomless boxes with hinged, gauze-covered lids, standing on the forest floor, in order that the date of emergence might be determined, but it was found to occur over such a long period (from 16th April to 25th May) that the dates for dusting the various stands were finally decided by counts of the eggs on felled specimen trees. Low temperature and heavy rainfall hindered emergence, which was apparently hastened by a rise of air temperature even when the soil temperature remained unchanged. The stimulus to emergence was the prolonged action of temperature above a certain limit.

The ground temperatures at which emergence began are recorded for this Noctuid and its parasites. The numbers of *P. flammea*, of the Tachinid, *Ernestia rudis*, Fall., and of various Ichneumonids emerging in the boxes were in the proportion 30 : 60 : 10. Emergence of *E. rudis* began on 15th May (about a month after that of the moth) and reached its maximum on 23rd May. The Ichneumonids emerged about 10–20 days later, from the end of May to early June. *Ichneumon pachymerus*, Htg., was by far the most abundant, but *Aphanistes armatus*, Wesm., was also very numerous, *Exochilum circumflexum*, L., coming third. Some individuals of *Meteorus albiditarsis*, Curt., *Tylocomnus scaber*, Grav., and *I. bilunulatus*, Grav., were also observed.

The moths emerged earlier in stands that had been partly defoliated in the preceding year, and the males emerged a few days before the females. A thick layer of forest litter was not always favourable for the pupae. Pupal mortality shortly before emergence was sometimes considerable ; it was greater in boxes with low humidity. The average number of eggs laid by a female was 120–130. Mortality in the egg stage only averaged about 5 per cent. ; the egg parasite, *Trichogramma evanescens*, Westw., was rare. It is in the first larval instar that *P. flammea* is most susceptible to adverse conditions, and an outbreak is brought about by the absence of such conditions over several years. Unfavourable conditions in the year of an outbreak cannot check the latter. It was estimated that natural mortality did not exceed 30 per cent. in the first instar or 10 per cent. in the second, third and fourth. During the last (fifth) instar the outbreak collapsed as stated above, scarcely a single healthy larva being found in the area during the summer.

BOAS (J. E. V.). **Ein ernster Angriff von** *Lyda arvenis* **Panz.** [A severe Attack by *Cephaleia arvensis*.]—*Z. angew. Ent.*, xx, no. 2, pp. 268–280, 13 figs. Berlin, July 1933.

An account is given of observations made on *Cephaleia* (*Lyda*) *arvensis*, Panz., in Denmark in 1929–32. A severe outbreak of this sawfly had occurred on spruce in 1929 [*R.A.E.*, A, xx, 312], its numbers having increased progressively during the two preceding years. The larvae were not abundant, however, in 1930, partly owing to egg parasitism by *Trichogramma evanescens*, Westw., and in 1932 the infestation was negligible. In 1930 no serious losses had been anticipated, but a large number of the trees died as a result of the previous year's attack, showing that *C. arvensis* can do considerable harm,

especially among trees exposed to drought by thinning and clearing. The statement that the new needles of a year are spared proved incorrect ; in this severe infestation the youngest needles were eaten after the older ones. Severely infested crowns were almost entirely enveloped in webs.

The five larval instars are described. A 2-year cycle was found to occur ; the larvae observed in 1929 soon entered the ground and did not emerge as adults till 1931. The pupal stage was short. In 1930 the first pupae were seen in January, and early in July adults only were observed. The Ichneumonid, *Xenoschesis fulvipes*, Grav., parasitised the larvae, probably ovipositing while they were feeding. Some larvae in the ground were attacked by *Botrytis tenella, Beauveria* (*Botrytis*) *bassiana, Spicaria*, sp., and *Isaria farinosa*.

Some of the dead or dying trees were infested by Scolytids, *Hylastes* (*Hylesinus*) *palliatus*, Gyll., and *Xyloterus lineatus*, Ol., being specially common, and *Ips chalcographus*, L., and *I. typographus*, L., occurring at the edges of the stands. The infestations were, however, only secondary and were not responsible for the death of the trees.

Körting (A.). **Beitrag zur Kenntnis der Entwicklung von** *Haplothrips aculeatus* **F.** [A Contribution to the Knowledge of the Development of *H. aculeatus*.]—*Z. angew. Ent.*, xx, no. 2, pp. 281–295, 7 figs., 10 refs. Berlin, July 1933.

This is a report on further observations made at Königsberg, Prussia, in 1931 on the biology of *Haplothrips aculeatus*, F., on cereals [*cf. R.A.E.*, A, xviii, 697]. The eggs were laid on the ears, and the larvae fed on stamens, ovaries and young grains. On rye or wheat flowers the first larval instar lasted 5–6 days at 20–22°C. [68–71·6°F.] and 8–12 at 16–18°C. [60·8–64·4°F.] ; on rye grains the corresponding periods were 10–13 and 14–22 days. The duration of the second instar was approximately the same, except that below 20°C. on rye grains it was about 6 days longer. Experiments indicated that the difference in rate of growth was due to the nature of the food and not to lack of moisture in the grains as compared with the flowers. The pre-pupal and pupal stages totalled 6–8 days at 20–22°C. and 9–12 at 16–18°C., and no significant differences due to different larval foods were noticed. An increase of air humidity did not influence the duration of the pupal stage. Young adults died in 1–2 days if starved, but older ones survived for 7 days without food, and 4 days without food or water. No differences were noticed in adult size or in duration of development of the sexes.

The hibernated adults attacked winter rye in the second half of May and winter wheat at the end of the month. At the end of June, summer cereals were infested, but less intensively. Oviposition began at the end of May, and the first adults of the new generation appeared in mid-July, this being the only generation produced during the year.

Counts showed adults of *H. aculeatus* to be nearly three times as numerous on winter rye as on winter wheat and more than twice as numerous on the latter as on barley or oats. Of all the thrips found on these four crops, the percentages represented by this species were 86, 73, 29 and 8 respectively. There were no differences in situation and soil of the fields examined. Records are given of numerous alternative food-plants, chiefly grasses. *H. aculeatus* has also been observed in Germany to attack the eggs of the beet fly [*Pegomyia hyoscyami*, Panz.].

LANGENBUCH (R.). **Beiträge zur Kenntnis der Biologie von** *Agriotes lineatus* **L. und** *Agriotes obscurus* **L. (II. Teil.).** [Contributions to the Knowledge of the Biology of *A. lineatus* and *A. obscurus*. Part II.]—*Z. angew. Ent.*, xx, no. 2, pp. 296–306, 1 fig., 13 refs. Berlin, July 1933.

Continuing previous studies [*R.A.E.*, A, xx, 492], the author describes laboratory experiments in which larvae of the Elaterids, *Agriotes obscurus*, L., and *A. lineatus*, L., avoided or migrated from soil in which a solution of kainit in water had been mixed at rates corresponding to those used in the field, and left untouched potato slices placed there. The action of kainit was found to be due chiefly to a disturbance of the unstable water-economy of the wireworms. The highly hygroscopic salt increases the absorbent power of the soil, which thus withdraws water from the body-fluid of the larvae until thirst compels them to ingest the salt solution in the soil, and the salt ions then injure their muscular and nervous systems. The action of kainit could probably be enhanced by an increase of its potash component, and it might be possible to employ water-soluble poisons not usually accepted by wireworms if they were mixed with it.

FAHRINGER (J.). **Ueber Braconiden und ihre Wirte.** [On Braconids and their Hosts.]—*Z. angew. Ent.*, xx, no. 2, pp. 307–323. Berlin, July 1933.

This first of a proposed series of papers on various Braconid genera of economic importance deals with the genus *Helcon*, of which *Gymnoscelus* and *Aspidocolpus* are regarded as subgenera. Keys to the subgenera and species are given, one specific key being arranged according to hosts. All the palaearctic species are described, showing their synonymy, hosts and general distribution.

ENDERLEIN (G.). *Chortophila rubicola* **n. sp., ein Schädling der Himbeertriebe.** [*Phorbia rubicola*, sp. n., a Pest of Raspberry Shoots.]—*Z. angew. Ent.*, xx, no. 2, pp. 327–328. Berlin, July 1933.

A description is given of *Phorbia* (*Chortophila*) *rubicola*, sp. n., reared from larvae infesting shoots of raspberry in nothern Germany.

BÖRNER (C.). **Die Verbreitung der Reblaus in Deutschland nach dem Stande des Jahres 1932.** [The Distribution of *Phylloxera* in Germany as shown by the Position in 1932.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 8, pp. 59–62. Berlin, August 1933.

In 1932, infestation of vines by *Phylloxera* was recorded in 12 new localities, as well as in 2 from which it had been absent for over 40 years.

Spritzschäden an Kirschen durch Verwendung von Fluornatrium zur Bekämpfung der Kirschfliege. [Spray Injury to Cherries due to the Use of Sodium Fluoride against the Cherry Fly.]—*NachrBl. deuts. PflSchDienst*, xiii, no. 8, pp. 63–64. Berlin, August 1933.

Bait-sprays containing 0·4 per cent. sodium fluoride with either 2 per cent. sugar or 4 per cent. molasses were used in Germany in 1931 and

1932 against the cherry fly [*Rhagoletis cerasi*, L.] without causing any injury to the trees. In 1933, however, fruits and leaves on branches heavily sprayed in June were scorched. The sprays should be applied lightly, thorough wetting being avoided.

KRÜGER (K.). **Zur biologischen Maikäferbekämpfung.** [On the Biological Control of Melolonthids.]—*Anz. Schädlingsk.*, ix, no. 8, pp. 106–107. Berlin, August 1933.

In view of the statement that infestation by Melolonthid larvae can be prevented by growing poppies [*R.A.E.*, A, xxi, 204], the author records an instance in Pomerania in which poppies planted in one half of a field were severely attacked, whereas sugar-beet in the other half remained untouched. Of 600 larvae transported for 2 hours in a box of soil in a cart, over 500 were killed by the movement of the soil during the journey, which illustrated their sensitiveness to its movement by cultural measures. It was found that the larvae could be successfully transported in damp peat instead of earth. Deep ploughing in autumn when frosts were expected has been found to be very effective, the larvae being exposed to the cold before they can regain a sufficient depth.

KRIEG (H.). **Untersuchungen an Reiskäfern.** [Investigations on Rice Weevils.]—*Mitt. Ges. Vorratsschutz*, ix, no. 4, p. 45. Berlin, July 1933.

The insecticidal effect of magnesium oxide [*cf.* *R.A.E.*, A, xx, 563] was tested with *Calandra oryzae*, L., from a shipment of wheat imported into Germany. Experiments with batches of 25 weevils, kept in glasses containing 0·5 gm. magnesium oxide mixed with 50 gm. wheat, showed the great influence on toxicity of temperature and humidity [xviii, 664]. At 13–17°C. [55·4–62·6°F.] no effect was noticed after 4–5 days. At an average of 17°C. (maximum 20°C. [68°F.], minimum 15°C. [59°F.]) and a relative air humidity of about 75 per cent., 2 weevils became inactive in 2 days and died in 4. At 20–22°C. [68–71·6°F.] with a humidity below 70 per cent., 20 weevils were dead after 4 days and all after 5.

The Pteromalid parasites, *Lariophagus distinguendus*, Först. (105 individuals) and *Chaetospila elegans*, Westw. (3), were obtained from a sample of wheat that produced 338 weevils.

PEUS (F.). **Flechtlinge als Wohnungs- und Materialschädlinge, besonders in Neubauten.** [Psocids as Pests of Dwellings and Materials, especially in new Buildings.]—*Z. GesundhTech. u. Städtehyg.*, xxv, no. 8, pp. 483–490, 2 figs., 2 refs. Berlin, August 1933.

The Psocids found in houses in Germany are usually species that have temporarily penetrated indoors. Those that only occur occasionally and rarely are *Tropusia oleagina*, Hag., *Liposcelis corrodens*, Heym., *Dorypteryx pallida*, Aar., *Lepinotus sericeus*, K., *Myopocnema annulata*, Hag., and *Pteroxanium squamosum*, Enderl. In new buildings where the paste used in hanging wall-paper is still undried, *Lachesilla pedicularia*, L., *Psyllipsocus ramburi*, Selys, and *Nymphopsocus destructor*, Enderl., are likely to be found, sometimes in such very large numbers as to prove a serious annoyance. As a rule they are not actually

harmful, as they usually feed on the moulds formed on the damp paper. Actual injury is generally caused only by *Liposcelis divinatorius*, Müll., *Lepinotus inquilinus*, Heyd., *L. reticulatus*, Enderl., or *Trogium pulsatorium*, L. Thorough drying of the premises usually ends the infestation, but where libraries, natural history collections, upholstered furniture or stored food-products are involved, it is necessary to trace the original centre of infestation and eliminate it. Dry heat of 50–60°C. [122–140°F.] kills Psocids in a few hours ; furniture, etc., should be stored, or fumigated with carbon tetrachloride or sulphur dioxide. For domestic use, naphthalene or paradichlorobenzene prevents the infestation of furniture.

Horn (W.). **Ueber Insekten, die Bleimäntel von Luftkabeln durchbohren.** [On Insects boring through the Lead Sheathing of Aerial Cables.]—*Arch. Post. Telegr.*, 1933, no. 7, pp. 165–190, 60 figs., 15 refs. Berlin, July 1933.

Recorded instances of injury to lead-sheathed aerial electric cables in various parts of the world are reviewed. In Germany, where such cables have become usual since 1924, 20 cases of damage have been noticed since 1929, all in Baden in the Rhine plain, never in the hills. Particulars of each instance are given, but it was impossible to ascertain the insect concerned. Notes are included on a number of Coleoptera that owing to their size and habits may have been responsible for the damage. It is considered likely that such cases would not occur if the cables were hung in carriers so designed as to afford no shelter for the insects, and if they had a smooth surface and were allowed to become covered by an oxidised layer, which would contain poisonous lead salts.

van Poeteren (N.). **Verslag over de werkzaamheden van den Plantenziektenkundigen Dienst in het jaar 1932.** [Report on the Work of the Phytopathological Service in 1932.]—*Versl. PlZiekt. Dienst*, no. 72, 148 pp., 8 pls. Wageningen, August 1933.

Many of the pests occurring in Holland in 1932 have been recorded in previous reports [*R.A.E.*, A, xx, 566, etc.]. Others include : the Elaterid, *Limonius pilosus*, Leske, which fed on apple blossom, causing serious damage on young trees with few flowers ; *Liothrips vaneeckei*, Priesn., on *Lilium martagon* imported from Italy ; *Coleophora laricella*, Hb., and *Epiblema proximana*, H.-S., attacking the needles of Douglas fir [*Pseudotsuga taxifolia*] ; *Lymantria monacha*, L., on *Pinus sylvestris* over an area of about 2½ acres ; *Cryptophagus cellaris*, Scop., which feeds on moulds, in stored rice ; larvae of the Pyralid, *Hypsopygia costalis*, F., in the lowest layers of stored clover hay ; and larvae of *Dilophus febrilis*, L. (*vulgaris*, Mg.) infesting wax in a bee-hive.

Burgess (R.) & Poole (E. J.). **Observations on the Susceptibility of Animal Fibres to Damage by the Larvae of two Species of Clothes Moth, *Tineola bisselliella* Hummel and *Tinea pellionella* L.**—*J. Textile Inst.*, xxii, pp. T141–T157, 7 refs. Manchester, March 1931. [Recd. September 1933.]

The following is substantially the authors' summary : Observations are described on the susceptibility of animal and vegetable fibres to

damage by the larvae of *Tineola bisselliella*, Humm., and *Tinea pellionella*, L., under natural and controlled conditions. The more important conclusions arrived at are that vegetable fibres and silk are not attacked by these clothes moths. Certain animal fibres such as alpaca, camel hair, cashmere, and goat hair are highly susceptible to attack, particularly when in their natural state. The natural fleece of the sheep is also readily attacked, but in the cases examined, the process of scouring enhanced its susceptibility. Partially processed sheep's wools containing vegetable oil are not favoured by clothes moth larvae, although such materials may not be considered to be immune. Fatty acids, applied in a concentration as high as 5·2 per cent. on the weight of wool, do not produce complete immunity. In this respect, these substances are inferior to certain mineral oils examined. Worsted cloth impregnated with solutions of "Larvex" and "Eulan" [*cf.* *R.A.E.*, A, xxi, 497, etc.] are satisfactorily proofed against the action of clothes moths. Infested wool stored in a closed atmosphere containing paradichlorobenzene is also efficiently protected.

HILLE RIS LAMBERS (D.). **Notes on Theobald's "The Plantlice or Aphididae of Great Britain."**—*Stylops*, ii, pt. 8, pp. 169–176, 5 refs. London, 15th August 1933.

This paper gives the results of an examination of the types of the Theobald collection of Aphids and is an attempt to correct some of the errors made by Theobald in his first volume on the Aphids of Britain [*R.A.E.*, A, xiv, 342]. The author considers Theobald's keys to be almost useless, as in many instances the characters and differences do not agree with his material. The classification of Börner [xviii, 636] is followed for practical reasons, though the author does not altogether agree with it.

The species dealt with include :—*Macrosiphum solanifolii*, Ashm., which is distinguished from *M. gei*, Koch ; *Acyrthosiphon onobrychidis*, Boy. (*Macrosiphum pisi*, Kalt.) ; *Aulacorthum solani*, Kalt. (*Myzus aquilegiae*, Theo., *M. duffieldi*, Theo., *M. pseudosolani*, Theo., *M. piceaellus*, Theo., *M. glaucii*, Theo., *M. hydrocotylei*, Theo., *M. convolvuli*, Kalt., *M. polyanthi*, Theo., *M. chelidonii*, Kalt., *M. neogei*, Theo., *M. mercurialis*, Theo.) ; *A.* (*M.*) *circumflexus*, Buckt. ; *Cryptomyzus* (*Capitophorus*) *ribis*, L. ; *Corylobion* (*Capitophorus*) *avellanae*, Schr. ; *Pentatrichopus potentillae*, Wlk. (*Capitophorus fragariae*, Theo., *C. fragaefolii*, Ckll.) ; *Nasonovia ribicola*, Kalt. (*Myzus lactucae*, Schr.) ; *Amphorophora lactucae*, L. (*cosmopolitana*, Mason) ; and *A. rubi*, Kalt. (*fragariella*, Theo.). *Illinoia* is considered a synonym of *Macrosiphum*.

FRYER (J. C. F.), GIMINGHAM (C. T.) & BUCKHURST (A. S.). **Report on Insect Pests of Crops in England and Wales 1928–1931.**—*Bull. Minist. Agric. Fish.*, no. 66, vi+50 pp., 1 map, 166 refs. London, H.M.S.O., 1933. Price 1s.

In this bulletin, which has been prepared on the same lines as the previous one [*R.A.E.*, A, xvii, 14], a general account is given of the occurrence of pests of cereal and vegetable crops, as well as of grasslands, flowers, bulbs and fruit and shade trees, together with a review of developments in methods of control and notes on insects intercepted from abroad.

Hill (L.) & Taylor (H. J.). **Locusts in Sunlight.**—*Nature*, cxxxii, no. 3329, p. 276, 2 refs. London, 19th August 1933.

The body temperatures of the solitary and gregarious hoppers [of *Locusta migratoria migratorioides*, R. & F.] were investigated by means of a pair of thermo-electric junctions, each made of fine copper and iron wire, one wire being threaded down a glass capillary tube, the other attached outside it and both soldered together at the opening of the tube. A temperature scale was made by recording the reading of the galvanometer when one junction was placed in warmer water than the other. One junction was then inserted under the pronotum of a black gregarious hopper, and the other under that of a green or buff solitary one. Each hopper had its legs and wings bound and the body fastened by a thread to the side of the capillary glass tube. The hoppers were then suspended in air, the other end of the glass being fixed to a lump of plasticine in a room free from sensible draughts, and their backs were exposed similarly to a carbon arc lamp, a quartz water screen, 4·2 cm. thick, being interposed to cut off long infra-red rays and make the arc's rays nearer to those of the sun. With the arc taking 6 amperes and the hoppers 12½ cm. from it, the temperature of the gregarious hopper was about 3·5°C. [6·3°F.] higher than that of the solitary one.

Pairs of hoppers were similarly exposed to direct rays of the sun on a clear day, and the gregarious hoppers were again about 3°C. [5·4°F.] warmer than the solitary.

Jones (H. A.). **Rotenone in a Species of *Spatholobus*.**—*J. Amer. Chem. Soc.*, lv, pp. 1737–1738. Easton, Pa., 6th April 1933.

The pure rotenone content of an acetone extract of root material of *Spatholobus roxburghi* from Burma was estimated to be 1 per cent. There are numerous plants of this genus, most of them indigenous to India, the Malay Peninsula and the Philippine Islands.

Nelson (O. A.) & Young (H. D.). **Vapor Pressures of Fumigants. V. α, β-Propylene Dichloride.**—*J. Amer. Chem. Soc.*, lv, pp. 2429–2431, 3 refs. Easton, Pa., 6th June 1933.

The boiling-point and density or specific gravity of propylene dichloride, as reported in chemical handbooks, appear to be taken from determinations made in 1871. Accurate determinations arrived at by modern methods show the boiling-point of α, β-propylene dichloride to be 96·4°C. at 760 mm., and the density 1·1545 g./cc. at 20°C. The vapour pressure [*cf. R.A.E.*, A, xviii, 648] conforms well to the equation log. $P_{mm}=7{\cdot}7085-(1782{\cdot}8/T$ abs.).

Haag (H. B.). **A Contribution to the Pharmacology of Anabasine.**—*J. Pharm. Exp. Therap.*, xlviii, no. 1, pp. 95–104, 3 figs., 8 refs. Baltimore, Md., May 1933.

The following is taken from the author's summary and conclusions : Anabasine, a natural alkaloid from *Anabasis aphylla*, and identical with the synthetic alkaloid neonicotine except for its influence upon polarised light, is both chemically and physiologically very similar to nicotine [*R.A.E.*, A, xx, 37]. In experiments it appeared to be more toxic than nicotine to guineapigs and rabbits, but nicotine is somewhat the more active on frogs and earthworms. Anabasine was somewhat less exciting and more depressing in its action than nicotine.

Koch (K. L.). **The Nature of Potato Rugose Mosaic.**—*Phytopathology*, xxiii, no. 4, pp. 319–342, 4 figs., 23 refs. Lancaster, Pa., April 1933.

An account is given of investigations in Wisconsin showing that rugose mosaic of potato is due to the combined effect of the mottle virus, normally present in apparently healthy potatoes, with the vein-banding virus. The mottle virus may be replaced in the combination by the potato ring-spot virus, with almost identical results. Both the mottle and the ring-spot viruses are easily transmitted by plant extract, but all attempts to transmit them by means of Aphids have failed [*cf.* *R.A.E.*, A, xix, 449]. The vein-banding virus, also transmissible by plant extract, is readily transmitted by *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm. Certain solanaceous plants are shown to be susceptible to this virus, suggesting the possibility of its transmission by Aphids from weeds to neighbouring potato plants, which, since they already harbour the mottle virus, would then develop rugose mosaic.

Hoggan (I. A.). **Some Viruses affecting Spinach and certain Aspects of Insect Transmission.**—*Phytopathology*, xxiii, no. 5, pp. 446–474, 5 figs., 23 refs. Lancaster, Pa., May 1933.

Previous investigations of cucumber mosaic on spinach and of its possible connection with spinach-blight [*R.A.E.*, A, xviii, 219] are reviewed, and the material and methods of the present one described. The virus was shown to be readily transmissible from tobacco to sugar-beet and *vice versa* by *Myzus persicae*, Sulz., and *Macrosiphum solanifolii*, Ashm. Systemic infection of sugar-beet with the cucumber mosaic virus was not obtained by artificial inoculation. The virus is apparently unable to pass from a single infected leaf of sugar-beet to other parts of the plant ; the infection caused by the feeding of Aphids that were not restricted to one leaf may have resulted from direct introduction of the virus at or near the growing point of the shoot.

The symptoms of cucumber mosaic on sugar-beet were not the same as those of sugar-beet mosaic, though both proved transmissible by the same two species of Aphids. Tobacco is known to be susceptible to cucumber mosaic [xvii, 282], but it was not found possible to infect it with sugar-beet mosaic by artificial inoculation ; attempts to infect it by means of Aphids caused certain symptoms to develop, but systemic infection did not follow.

The cucumber mosaic virus proved to be readily transmissible from tobacco to spinach and from spinach to spinach by means of either *M. persicae* or *M. solanifolii* and also by artificial inoculation. The susceptibility to this virus of the Virginia Savoy variety of spinach, which is highly resistant to spinach-blight, varied at different seasons ; at times a high degree of Aphid infection was obtained, at others none at all. The Bloomsdale variety was much more susceptible. The transmission of sugar-beet mosaic from sugar-beet to spinach and from spinach to spinach was also effected by both species of Aphids and by inoculation. Tobacco ring-spot virus was transmitted to spinach by inoculation but not by these Aphids [*cf.* xix, 449].

In experiments with *M. solanifolii*, which are described, and others with *M. persicae*, which are not yet published, no evidence was found of direct transmission of the cucumber mosaic virus from infective

adults to their offspring. In spite of contrary results apparently obtained with the virus of spinach-blight [vi, 454], the author considers that the two diseases are probably identical. A comparison of the symptoms, however, suggests that the mosaic disease of spinach prevalent in Germany [xv, 373] is probably sugar-beet mosaic.

Handbook for Citrus Insect Control for 1933.—*Bull. Calif. Fruit Gr. Exch.*, no. 10. [6 pp.]. Los Angeles, Calif., July 1933.

Scheduled recommendations are given for control measures to be applied against insects attacking *Citrus* in each of the interior and coastal districts of California [*cf. R.A.E.*, A, xx, 569]. In Arizona, where the only *Citrus* pest of importance is the thrips [*Scirtothrips citri*, Moult.], three applications of sulphur dust are recommended; the first (at the rate of 1 lb. per tree) to be made when the first brood of larvae appear, usually early in March, the second (¾ lb.) when most of the petals have fallen, and the third (½ lb.) three weeks later.

In orchards sprayed between October and March with Bordeaux mixture against brown rot, winter fumigation against red scale [*Chrysomphalus aurantii*, Mask.] has caused severe injury even when delayed until late April. It has now been shown that a spray of 8 lb. lime and 8 lb. zinc sulphate in 50 U.S. gals. water, although rather less effective than Bordeaux mixture (3 lb. lime and 3 lb. copper sulphate in 50 U.S. gals.) is a suitable substitute for it and is compatible with hydrocyanic acid gas.

Ebeling (W.). **Laurel-sumac as a Source of Red Scale Infestation.**—*Calif. Citrogr.*, xviii, no. 1, p. 4, 2 figs. 1932. (Abstr. in *Expt. Sta. Rec.*, lxix, no. 1, pp. 77–78. Washington, D.C., July 1933.)

Attention is called to the importance of destroying the laurel-sumac [*Rhus laurina*] growing near plantations of *Citrus* in California, particularly if the shrub is infested with the red scale [*Chrysomphalus aurantii*, Mask.].

Sweetman (H. L.) & Wedemeyer (J.). **Further Studies of the Physical Ecology of the Alfalfa Weevil,** *Hypera postica* **(Gyllenhal).**—*Ecology*, xiv, no. 1, pp. 46–60, 5 figs., 13 refs. Brooklyn, N.Y., January 1933.

The studies here described, which supplement those made in the field in Wyoming [*R.A.E.*, A, xviii, 350; xx, 526], deal with the effect of temperature and humidity on the development of *Hypera variabilis*, Hbst. (*postica*, Gyll.) in controlled laboratory environments. The following is substantially the authors' summary: The favourable region for oviposition was apparently below 28°C. [82·4°F.] with a relative humidity of 50–95 per cent. Temperatures of 30–37°C. [86–98·6°F] were injurious to the adults, especially when the relative humidity was high (88–93 per cent.), and higher temperatures were fatal within a few days; above 27°C. [80·6°F.], relative humidities below 40 per cent. were very destructive. The favourable region for hatching was about 20–30°C. [68–86°F.], with relative humidities of 55–95 per cent. At 32–34°C. [89·6–93·2°F.], a low percentage of eggs hatched, but the incubation period was very short (about 6 days, as against 9–12 days at 22°C. [71·6°F.]). Higher temperatures destroyed the embryos. The minimum effective temperature for incubation was about 10°C.

[50°F.]. Relative humidities below 40 per cent. were very destructive to the embryos. The favourable range of temperature for larval development was about 20–30°C. with relative humidities ranging from 95 to at least as low as 30 per cent.; above about 34°C., the larvae died. The minimum effective temperature during the feeding period was about 10°C.; during the pupal period it was slightly higher.

Douglass (J. R.). **Additional Information on Precipitation as a Factor in the Emergence of** *Epilachna corrupta* **Muls. from Hibernation.**—*Ecology*, xiv, no. 3, pp. 286–297, 5 figs., 1 ref. Brooklyn, N.Y., July 1933.

This paper gives some results of a study of the emergence of overwintered adults of *Epilachna corrupta*, Muls., from forest cages and natural hibernation in Estancia Valley, New Mexico, including data obtained in 1930 [*cf. R.A.E.*, A, xvi, 402; xxi, 412]. The following is taken from the author's summary: Permanent emergence rarely occurs when the mean daily temperature is below 50°F. Rainfall is the initial stimulus. Temperature during and subsequent to rainfall is important; increasing temperature accelerates emergence and decreasing temperature retards it. The peak of the overwintered beetle infestation in the field is subsequent to the peak of emergence from the cages. The stimulating effect of contact moisture is greater than that of atmospheric moisture. Where natural precipitation is excluded, beetles may be stimulated to emerge at will by supplying water to simulate rainfall after the mean temperature has risen above the threshold of activity.

Eshbaugh (F. P.). **Progress Report on Studies of the Pale Western Cutworm,** *Agrotis orthogonia* **Morrison.**—*Panhandle Bull.*, no. 45, 14 pp., 3 figs., 3 refs. Goodwell, Okla., January 1933. [Recd. August 1933.]

Porosagrotis (*Agrotis*) *orthogonia*, Morr. (pale western cutworm) appeared for the first time in north-western Oklahoma in 1928, and the larvae caused severe damage to wheat over large areas in the two following seasons. No noticeable injury has occurred since 1930, however, though larvae have been observed. The increase of the moth is due to a dry condition of the soil during May–June, which allows the larvae to work far enough below the surface to avoid parasitism [*R.A.E.*, A, xi, 459, etc.]. The eggs are laid in loose soil in September–October, but apparently do not hatch until the end of February or later. Larvae have been found from March to June at a depth of ½–2 ins. below the surface. The prepupal and pupal stages both last several weeks, pupation occurring at a lower level than that at which the larvae normally feed. The moths emerge from mid-September to mid-October. In Oklahoma the prepupal stage appears to be longer than further north, which may account for the insect's ability to withstand the higher temperatures in summer. Characters by which *P. orthogonia* may be distinguished from other Noctuids flying during the summer are briefly indicated. It was found that moths for identification could best be caught by a light-trap having a screen on which they are electrocuted.

Cultural control methods are recommended, including the usual practice of ploughing the stubble immediately after harvest, as crops sown in stubble are generally heavily infested [xviii, 623]. On the

other hand, where the soil is kept finely pulverised and cleanly cultivated during most of the late summer and autumn or broken up by the destruction of a late crop of self-sown wheat just before planting, favourable conditions are produced for oviposition, and it is suggested that the use of a cultipacker may be of value in packing the soil during the flight of the moth. Planting should not take place during this period in infested areas, even in the presence of moisture. Autumn frosts are not likely to prove of value in killing the moths. Observations indicated that the larvae do not migrate further than 15 ft., and unplanted strips may be left at intervals in large fields and tilled to attract oviposition. Where serious damage has occurred over a period of years, local rotation of crops might be of value.

HANSON (A. J.). **The Blackberry Mite and its Control** (*Eriophyes essigi* **Hassan**).—*Bull. Wash. Agric. Expt. Sta.*, no. 279, 20 pp., 1 pl., 6 figs., 9 refs. Pullman, Wash., April 1933. [Recd. August 1933.]

This bulletin deals with the results of a study of the bionomics and control of *Eriophyes essigi*, Hassan (blackberry mite), which is a serious pest of blackberries and also attacks raspberries and loganberries in Washington State [*R.A.E.*, A, xx, 21]. In 1931 and 1932, only 35 per cent. of the harvested blackberries were free from infestation. Lightly infested berries ripen normally ; " red berries " in late September were found to contain from less than 100 to as many as 683 mites. The number of drupelets that remain red appears to depend on the duration of infestation of the berries ; in early-maturing bush varieties, the fruits may often ripen before the mites become established in them. The eggs and mites are briefly described. The life-cycle from egg to adult is short (probably occupying 8–11 days), and there are many overlapping generations a year. In autumn the mites migrate from the berries as they decay to the axis of the cane-buds and the compound leaf, and as the winter advances, more are found inside the buds between the scales [*cf. loc. cit.*]. The mortality during autumn and winter is high, partly owing to the activity of the predacious Gamasid, *Seius pomi*, Parrott, which overwinters in the adult stage, the eggs (which were first observed on 16th March) usually being laid singly in the berries or buds and occasionally on the leaves. *E. essigi* appears to be very resistant to low temperatures when in the bud, being unaffected by subjection in the field to 21°F. Eggs were first observed on 8th March and were numerous 11 days later. Infestation reaches its height in September and decreases during the autumn and winter, no eggs being found after 20th December. The mites do not enter the flowers as in California and England [xiv, 248 ; xx, 143], but migrate later in the year (July) direct to the green berries. Some, however, remain in the scales of the old winter cane-buds until the following autumn. Distribution from row to row is mainly effected by air currents.

Spraying experiments carried out in 1931 and 1932 are discussed. The programme recommended comprises two sprays of liquid lime-sulphur (32°Bé.), the first applied at the rate of 5 : 100 to the new canes after the removal of the old ones in autumn, or at 6 : 100 between 15th March and 1st April, and the second at 1 : 40 between 10th and 20th May. The most effective single spray is lime-sulphur (1 : 40) applied about 18th July, but this cannot be used if fruit is to be tinned, in which case the autumn spray is the most satisfactory single treatment.

If a summer spray is desirable, refined summer oils should be used, but not following the application of a sulphur spray, in view of the danger of injury to the foliage. As soon as the berries are harvested, the old canes should be removed and burnt, thus destroying many mites before they reach the new cane buds.

Hanson (A. J.). **The Potato Flea Beetles** *Epitrix cucumeris* **Harris,** *Epitrix subcrinita* **Leconte.**—*Bull. Wash. Agric. Expt. Sta.*, no. 280, 27 pp., 13 figs., 13 refs. Pullman, Wash., April 1933. [Recd. August 1933.]

An account is given of observations on the bionomics of *Epitrix cucumeris*, Harr., and *E. subcrinita*, Lec., on potatoes in Washington State [*cf. R.A.E.*, A, xx, 684, etc.]. The food-plants were found to be chiefly solanaceous. One generation and a partial second occur annually, the adults hibernating in the field in soil or débris [*cf.* xviii, 541]. They reappear during May–June, and the majority of those of the new generation emerge from the ground from 25th July to 17th August. The number of adults present in the field increases gradually during June and the early part of July and more rapidly in late July and early August, after which (from 25th August) it decreases, none being found after early November. The amount of injury to foliage varies correspondingly, heavily infested plants sometimes dying during August. Injury to the tubers by the larvae is most severe in potatoes planted between 19th April and 1st June, the greater part being caused in the latter part of July. It is accentuated by secondary infestation by scab (*Actinomyces scabies*) and *Rhizoctonia* [xviii, 216]. Larvae of *E. cucumeris* were found to be parasitised internally by a Nematode closely related to *Howardula benigna*, Cobb, and some adult flea-beetles were killed by a fungus, *Entomophthora* sp., with which a low mortality was obtained in inoculation tests.

Experiments were carried out during 1931–32 with various insecticides that have been recommended for the control of the beetles. Tubers from plants sprayed with pyrethrum (9 applications) or nicotine sulphate were almost as much injured as those from untreated plants, since no lasting toxic residue was left on the plants, and very few beetles came into actual contact with the sprays. Bordeaux mixture (4–4–50) alone, though it repelled a certain number of adults, did not prevent oviposition, and reduced tuber injury less than foliage injury. When it was combined with calcium arsenate [xx, 589], effective control was obtained against fungi and the beetles on the late crop. Either in dusts or sprays, this was the most effective of various arsenicals tested, and barium fluosilicate of the fluorine compounds ; cryolite and sodium fluosilicate, though they gave a better control, severely scorched the foliage. Dusting at intervals of 10–14 days with calcium arsenate and lime (1 : 4) or barium fluosilicate and diatomaceous silica (1 : 1) is recommended for plants that are not ready for harvest by 8th July. The effectiveness of the fluosilicate was not appreciably reduced by combination with lime [*cf.* xix, 357]. Dusts proved more effective than sprays. During the initial stages of infestation, only the outer edges of fields of one acre or more need be dusted, but as soon as it becomes general, the whole field will require treatment. Applied on 28th June as soil fumigants and repellents, crude naphthalene flakes reduced the injury to the tubers by 38·6 per cent., and paradichlorobenzene by 34·8 per cent., neither causing injury to the plants.

Early potatoes should be planted before 19th April (if possible, during early March), so that they may make as much growth as possible before the adults begin ovipositing [but *cf*. xviii, 541]. Late potatoes planted between 15th June and 15th July may develop tubers relatively free from damage without the use of an insecticide.

LYNE (W. H.). **Report of Chief Plant Quarantine Officer.**—*27th Ann. Rep. Brit. Colombia Dept. Agric. 1932*, pp. U23–U29. Victoria, B.C., 1933.

Pests intercepted in British Columbia during 1932 from countries outside North America were: *Aspidiotus perniciosus* Comst., *A. ostreaeformis*, Curt., and *A. rapax*, Comst. (*Diaspis camelliae*, Sign.) on ornamental shrubs, *D. carueli*, Targ., on juniper, and *Chionaspis furfura*, Fitch, on maple, all from Japan; *Aspidiotus hederae*, Vall. (oleander scale) on lemons from Italy; *Lepidosaphes beckii*, Newm. (*Mytilaspis citricola*, Pack.) on lemons and oranges from Jamaica and lemons from Italy; *Pseudococcus brevipes*, Ckll., on fresh pineapples and coconuts from Hawaii; *Hylemyia brunnescens*, Zett., on carnations, and *Eumerus strigatus*, Fall., on narcissus, both from England; *Merodon equestris*, F., on narcissus bulbs from Holland, England and Scotland; the mite, *Rhizoglyphus echinopus*, F. & R., on bulbs from England and Holland; and *Plodia interpunctella*, Hb., in shelled almonds and raisins from Spain, ground-nuts and shelled walnuts from China and lima beans from Madagascar.

RUHMANN (M. H.). **Report of Provincial Entomologist.**—*27th Ann. Rep. Brit. Columbia Dept. Agric. 1932*, pp. U34–U38. Victoria, B.C., 1933.

Insects that were numerous during 1932 in British Columbia included: *Eriosoma lanigerum*, Hausm., on apple; *Brevicoryne* (*Aphis*) *brassicae*, L., on cabbage; the Meloid, *Epicauta maculata*, Say (spotted blister beetle), which was locally injurious to field crops; *Hylemyia antiqua*, Mg. (*Pegomyia ceparum*, Mg.), which caused severe damage to onion in untreated fields; and *Galerucella luteola*, Müll., on elms.

Owing to particularly favourable weather conditions, there was an increase of *Cydia* (*Carpocapsa*) *pomonella*, L., on apples; as the result of a great improvement in the application of sprays, however, infestation was considerably reduced in orchards that were heavily infested in 1931 [*R.A.E.*, A, xx, 593]. In experiments, applications to trees over 20 years old of 1 calyx and 4 cover sprays of 3 lb. lead arsenate in 80 gals. water with a spreader reduced the original infestation of 42 per cent. in 1931 to an average of 1·4, 4·4 per cent. infested fruit being observed in a plot in which the calyx spray was omitted.

PREBBLE (M. L.). **The Larval Development of Three Barkbeetles.**—*Canad. Ent.*, lxv, no. 7, pp. 145–150, 1 graph, 4 refs. Orillia, July 1933.

In the course of investigations on Canadian bark-beetles [*R.A.E.*, A, xvii, 623], studies were made in New Brunswick of the larvae of *Dendroctonus simplex*, Lec., *Ips* (*Pityokteines*) *sparsus*, Lec., and *I. pini*, Say, with material collected in the summer of 1929 from larch, balsam fir [*Abies balsamea*] and white pine respectively. *D. simplex* was found to have 4 larval instars and the other species 3, and their

growth conformed satisfactorily with Dyar's Law [*cf.* xx, 579]. In breeding cages, the average length of the life-cycle of *D. simplex* was 45 days, that of *I. pini* was 31 in sunlight and 48 in moderate shade, and that of *I. sparsus* about 6 weeks.

CRIDDLE (N.) & HANDFORD (R. H.). *Lema trilineata* **Oliv. in Manitoba (Coleoptera, Chrysomelidae).**—*Canad. Ent.*, lxv, no. 7, pp. 150–151, 1 fig., 1 ref. Orillia, July 1933.

The differences in the food-plants and seasonal life-history of *Lema trilineata*, Ol., in Manitoba and in the eastern part of Canada and the United States, where it attacks potatoes, may indicate the existence of distinct biological races. In Manitoba, only one generation occurs in a season as compared with two in the east of the continent, and adults are present in the field late in May. Pairing begins almost immediately, and eggs have been observed on 6th June, hatching within about 13 days. All stages are usually present until about 22nd July, and adults may be seen occasionally during August. Beetles reared in the laboratory fed little and were largely inactive ; they failed to hibernate successfully in captivity. This Criocerid has not been observed on potato in Manitoba ; larvae caged with potatoes died in 3 days without feeding and adults fed little and laid only 0–25 eggs. The larvae developed normally on ground-cherry (*Physalis lanceolata*), the preferred food-plant, and females deposited 118–325 eggs, with an average of 207·8. Other plants attacked are *P. grandiflora*, *P. edulis* and henbane (*Hyoscyamus niger*), but not *Solanum triflorum* nor *S. nigrum*.

McDUNNOUGH (J.). **Biological Notes on some of our eastern Ontario** *Haploptilia* **species (Lepid.) with Descriptions of two new Species.**—*Canad. Ent.*, lxv, no. 7, pp. 160–168, 22 figs. Orillia, July 1933.

Brief notes are given on the biology, and in most instances also on the appearance of the larval cases, of a large number of species of *Coleophora* (*Haploptilia*). Two new species are described (from *Monarda fistulosa*), and two others are recorded for the first time from Canada. Cases of *C.* (*H.*) *fletcherella*, Fern., were numerous in June on apple, adults emerging in late June or early July, and others were found on *Crataegus* and wild cherry. *C.* (*H.*) *pruniella*, Clem., is a fairly serious apple pest in Quebec, where it also occurs on *Crataegus*, *Prunus virginiana* and *P. serotina*. It is comparatively common on *P. serotina* in the Ottawa district and was occasionally found on it in eastern Ontario. In the summers of 1931 and 1932, larvae of this species feeding on *Myrica* in this area were heavily parasitised by a Braconid, apparently *Microbracon pygmaeus*, Prov.

BOX (H. E.). **Studies on early larval Mortality of** *Diatraea saccharalis* **in Antigua with special Reference to natural Parasitism of Eggs by** *Trichogramma*—*Bull. 4th Congr. Int. Soc. Sugar Cane Technol.*, no. 122, 6 pp., 1 ref. San Juan, Puerto Rico, March 1932. [Recd. August 1933.]

As the result of a preliminary study carried out in Antigua during 1931–32, the author presents in tabular form evidence of the apparent economic impracticability of artificially rearing and distributing *Trichogramma minutum*, Riley, for the control of *Diatraea saccharalis*, F., on sugar-cane [*cf. R.A.E.*, A, xx, 582]. In one field examined in April

1931, where no trace of parasitism was observed, a comparison of the number of larvae found on the stools with that of eggs from which larvae had emerged suggested that 92 per cent. of the latter had died before entering the stalks. In another field, the estimated number of *Diatraea* eggs per acre (nearly 290,000) was practically the same in February 1932 as in the preceding April, although parasitism had increased from 1·4 to 75·4 per cent. in the 10 months. In another, containing approximately 1,500,000 host eggs per acre, it was estimated that the parasites were emerging between December 1931 and February 1932 at an average rate of 35,000 per acre per day without increasing the percentage of parasitism or reducing infestation. The maximum number yet colonised in countries where a reduction in borer infestation is claimed is about 2,500 per acre per year, or about 7 per day. The author concludes that even a high degree of parasitism by *T. minutum* does not appreciably affect the borer population supported by a heavily infested area. Should liberations be necessary for experimental purposes, it is much less costly to strip the leaves from plants in a mature field where the parasites are abundant and to transport the egg clusters to the new area, than to erect and maintain elaborate equipment for rearing *Trichogramma* on an alternative host such as *Sitrotroga cerealella*, Ol.

BEDFORD (H. W.). **Report of the Government Entomologist for the Year 1932.**—*Bull. Wellcome Trop. Res. Lab. Sudan Govt.*, Ent. Sect., no. 36, 35+3 pp. multigraph, 1 map. Khartoum, January 1933. [Recd. August 1933.]

No serious outbreaks of locusts occurred in the Sudan in 1932, in spite of a good rainy season in the northern and central regions. Details are given of the incidence in the different months and districts of *Schistocerca gregaria*, Forsk., and *Locusta migratoria migratorioides*, R. & F., and the areas in which they bred are shown in a map. Swarms of *S. gregaria* invaded the Sudan between June and August, apparently from three different directions, but they were few and small, so that only a very limited amount of breeding occurred. A return migration took place in October, and by the end of the month the Sudan, with the exception of the Red Sea littoral, was apparently free from swarms. *L. m. migratorioides* continued to breed throughout the year, both adults and hoppers being present in the southern Sudan during January–March and again in May. Northward movement was noticed during April and June, and many flying swarms were observed in the central region during July, August and September, though breeding was confined to isolated areas. No records of flying swarms were received from the northern or central Sudan in October, or of any hoppers during November. Although immigrant swarms of *L. m. migratorioides* invaded the western and central Sudan in numbers sometimes even greater than the preceding year, the proportion that bred was remarkably small.

The extent of the damage caused by both species to the various crops is discussed; though in certain isolated areas the injury was considerable, the total loss as compared with the previous year was extremely small. Sun-dried bran bait was again used with success for the control of the hoppers [*cf. R.A.E.*, A, xx, 623]. In the case of *L. m. migratorioides*, it was sometimes necessary to spread the bait in the very early morning or late afternoon, as the hoppers of this species, particularly when young, only feed during the cool hours of the day.

Birds destroyed enormous numbers of hoppers; parasites of the hoppers and adults included Calliphorid, Bombyliid and Tachinid larvae, *Mermis* sp. and mites.

Platyedra gossypiella, Saund., was the most serious pest of cotton in the Berber Province, its rapid increase early in the season being favoured by a prolonged rainy period. It is suggested that the native practice of retaining for household purposes a proportion of the crop from late pickings, which probably contains a high percentage of the resting-stage larvae, forms the chief means by which the insect survives the dead season. *Diparopsis castanea*, Hmps. [*cf.* xix, 165], which had been relatively scarce since the outbreak in 1927–28, reappeared in numbers in the autumn of 1932. Experiments at Shendi (Berber Province) indicated that the resting pupae in the soil are detrimentally affected by constant applications of water, and the practice of irrigating the land before ploughing has now been adopted there. *Dysdercus* was absent from the Talodi district in Southern Kordofan, as a result of control measures during the previous dead season. These consisted in spraying infested baobab trees (*Adansonia digitata*) with kerosene and setting fire to them [xxi, 485], while other trees were pollarded and the fruits collected and burnt. *Hercothrips fumipennis*, Bagn. & Cam. [*cf.* xx, 620, 621], was numerous in November on the older leaves of cotton in the Gash Delta (Kassala Province), causing leaf-shedding. No infestation occurred, however, where tall weeds had been allowed to grow up and surround the lower leaves of the cotton, and owing to ideal soil conditions in this district and a continuous supply of underground moisture, the vigorous growth of the plants counterbalanced the damage done. *H. sudanensis*, Bagn. & Cam., attacked cotton from December onwards in varying degrees, and as it causes leaf-shedding when the plants are producing bolls, it tends to do more serious damage to the crop. W. P. L. Cameron reports from the Gezira area that enormous numbers of adult thrips, over 50 per cent. of which were *H. fumipennis*, migrated to cotton and *Dolichos lablab* during the first week of November.

The Noctuid, *Sesamia cretica*, Led. (dura stem-borer), which continued to cause considerable damage to dura [*Sorghum*] and maize, was largely checked in the Shendi district by the Hymenopterous parasite recorded in 1929 [xix, 395]. The Pentatomid, *Agonoscelis versicolor*, F., caused much injury to *Sorghum* in a district of Kassala, whereas practically no infestation occurred in southern Gezira owing to the spraying campaign carried out in April against the bugs clustering in shrubs and trees [*cf.* xix, 166]. In view of the probability that *Tanymecus sparsus*, Fhs. [*cf.* xix, 392] may spread to new areas of *Sorghum*, a preliminary investigation on its bionomics was made. During the rains the weevils were very numerous on various weeds, particularly *Ipomoea cardiosepala*, and when these dried up, they migrated from them to the young *Sorghum*, the infestation lasting until the advent of the cooler weather. Late sown *Sorghum* may, therefore, escape infestation. The weevils feed at night, hiding during the day at the base of the plants in the soil.

The larvae of *Catopsilia florella*, F., continued to be destructive to senna in the northern Sudan; the natural food-plant of this Pierid is wild senna (*Cassia obovata*), from which it spreads to the cultivated crop. The eggs are laid singly on the leaves, on which the larvae feed, thus retarding the growth of the plant and greatly reducing the early pickings of pods. In August the life-cycle from egg to adult averaged

18 days. Dusting with Paris green in July and part of August killed all larvae present at the time, but a succession of overlapping broods occurred on the wild senna, from which the adults migrated to the cultivated crop to oviposit, and as the dust was removed from the leaves by wind and rain, several applications at intervals were necessary.

BRASNETT (N. V.). **Annual Report of the Forest Department (Uganda) for the Year ended 31st December, 1932.**—Folio, 21 pp. Entebbe, 1933. Price 1*s*. 6*d*.

In the section dealing with the protection of forests in Uganda (pp. 7–9), it is stated that a study of *Phytolyma* sp., which causes galls on *Chlorophora excelsa*, showed that the life-cycle from oviposition to the emergence of the adult occupies 21 days and that the galls are apparent after 9. In the case of healthy, rapidly growing plants, they are formed on the outer tissues of shoots, and not on the growing points. The maintenance of vigorous growth in young plants, combined with weekly inspection and slicing open the galls, will therefore probably afford sufficient protection. The most important of various shoot-borers is probably an unidentified one attacking young plants of *Khaya anthotheca* in group planting in natural forest, though as yet the injury caused is not great. The desert locust [*Schistocerca gregaria*, Forsk.], damaged *Eucalyptus* in anti-malaria plantations, in two localities, in some cases eating young trees up to 5 ft. high. Termites are a serious pest in dry areas and wet-weather marshes ; digging out the queens from the nests is a cheaper and more effective measure of control than any fumigation methods tried.

LEWIN (C. J.). [**Insect Pests.**]—*Ann. Rep. Dept. Agric. N. Rhodesia 1932*, 27 pp. Livingstone, 1933.

Dysdercus superstitiosus, F., which appears first in the cotton field when flowering begins and is responsible for damage to the first crop, and *D. fasciatus*, Sign., which appears later and causes the large amount of staining found in the late crop, are the most important cotton stainers in Northern Rhodesia [*cf. R.A.E.*, A, xx, 243]. The percentage of the mature crop affected was 62·4 in 1931 and 35·4 in 1932. *Thespesia rogersi* [*loc. cit.*] and *Adansonia digitata* [*cf.* xxi, 485] are alternative food-plants. *Hibiscus* spp. appear to be the normal annual food-plants ; considerable numbers of *D. superstitiosus* were found from January to June 1932 over large areas of pure stands of *H. cannabinus*, which is by far the most abundant species, and it is possible that the relative scarcity of this stainer on cotton in 1932 was due to its attraction to *Hibiscus*. Investigations over 3 years have shown that the use of cotton-seed traps and hand-picking, either separately or in combination, are of no practical value for the control of *Dysdercus* ; in several instances, despite the removal of large numbers (170,000 from one acre in one field), no reduction in damage as compared with untreated areas was observed. The maximum population of *Heliothis* (*Chloridea*) *obsoleta*, F. (American bollworm) occurs in March–April, but varies in intensity each year. In 1931, about 54 per cent. of the crop originally set was shed and 1 per cent. of the mature crop was damaged. *Earias insulana*, Boisd., was less injurious. Experiments carried out for 2 years on the effect of delayed planting showed that, though it resulted in a reduction in damage by the bollworms, much less crop was set than in the earlier plantings, which are therefore

preferable. Of various strains of cotton, medium-early maturing ones were found to be the least injured. A very early strain failed because it carried a large proportion of its crop during the peak of the early stainer infestation.

An account is given of the situation during 1931–32 as regards *Locusta migratoria migratorioides* R. & F., and the red locust [*Nomadacris septemfasciata*, Serv.] [*cf.* xx, 499]. The latter spread to practically every district in 1932 and oviposited on a hitherto unprecedented scale, hoppers beginning to emerge towards the end of the year. A locust control campaign with poison sprays, inaugurated late in 1931, was abandoned in February 1932, and attention was concentrated on the protection of native gardens. An abundant harvest was obtained, damage being mainly confined to part of the crop of *Eleusine coracana* destroyed by flying swarms in March and April. A chemical smudge [*cf.* xxi, 366] composed of 7 parts by weight coal tar, 9 parts sodium nitrate, 5 parts sulphur, and $2\frac{1}{2}$ parts borax is recommended as supplementary to slow grass or brushwood fires. When primed with a little sodium nitrate, it may be readily ignited by a blow lamp or fuse igniter and in partly covered tins produces large volumes of acrid smoke.

In the annual report of the Forestry Branch for 1932, D. Stevenson states (pp. 19–27) that termites are the most serious pest of exotic trees in Northern Rhodesia, *Eucalyptus, Casuarina* spp., and *Grevillea robusta* being particularly susceptible to attack in the areas of lower rainfall. Ants have been observed to eat the cotyledons of *Baikiaea plurijuga*. *Eucalyptus* was defoliated by the grasshopper, *Phymateus viridipes*, Stål, and the bark of the shoots and young stems was stripped by *Macropoda* sp.

MALLAMAIRE (A.). **Les Borers du Caféier en Basse Côte d'Ivoire. Le** *Monohammus sierricola* **White et l'***Apate monachus* **F. dangereux parasites des caféiers dans le Sud-Est de la Basse Côte d'Ivoire (Cercle d'Assinie).**—*Bull. Com. Afr. occid. fr.*, xv, no. 2–3, pp. 425–455, 8 figs., 5 pls., 1 ref. Paris, 1933.

Descriptions are given of the larva, pupa and adult of the Lamiid, *Bixadus* (*Monohammus*) *sierricola*, White, and of the larva and adult of the Bostrychid, *Apate monacha*, F., both of which attack coffee in the Ivory Coast. The adults of the Lamiid, which is far the more important pest [but *cf. R.A.E.*, A, xix, 736], are most numerous during the dry season (December, January and February), a smaller number emerging in August. They do not fly far, so that isolated foci of infestation often occur in large plantations. They live 15–20 days only, hiding by day and becoming active at nightfall. They scarcely feed at all, but drink dew-drops on the leaves. Pairing takes place soon after emergence, and oviposition occurs in cracks on the bark of the stems of old and young coffee plants. Contrary to statements in the literature [*loc. cit.* and xix, 55], perfectly healthy ones are attacked. One female probably lays about 50–60 eggs, no preference being shown for any special variety of coffee. Upon hatching, the larvae enter the stem, in which they bore galleries ; these may extend as low as a foot below the root collar, or as high as 7 ft. above the ground. The larvae feed for 5–6 months, and before pupating, enter a resting period for 7–8 days ; the pupal stage lasts 20–30 days. As many as 5–10 larvae have frequently been found in the stems of trees 6–10 years old. The larvae often abandon the galleries and establish themselves under the bark in

the sap-wood, in which they eat out more or less regular circular bands 1–2 ins. wide, which kill the tree in a few days by interrupting the flow of sap. Infested trees are often broken by wind or attacked by termites, bacteria or fungi.

Damage due to *A. monacha* is caused by the adults, the larvae developing in the dead wood of various trees, including cacao, which is often attacked. The adults are very active and gregarious in their habits. They alight at night on perfectly healthy coffee trees, usually 2–4 years old, in which they bore galleries at dawn. The entrance hole is always in the side facing the rising sun, apparently because the beetles remain torpid during the damp nights. On reaching the heart-wood, they begin tunnelling upwards ; their presence is revealed by accumulations of fine dust at the base of the trees. The entrance holes occur from the root-collar to the tip of the stem, and 4–6 beetles may be present simultaneously in one gallery. In one instance a three-year-old tree of *Coffea liberica* was found to contain 12 entrance holes, the galleries harbouring about 30 beetles, which had completely hollowed out the stem. Preference is shown for thin trees with stems of about 2–2½ ins. in diameter ; in thicker trees the attacks are limited to branches. The infested plants often dry up and die or are attacked by fungi. Infestation is most rapid in plantations that have been recently cleared of weeds.

To combat *B. sierricola*, the coffee trees should be planted at least 8–10 ft. apart, and about 30–40 yds. from the edge of the forest, where the beetles usually breed ; the intervening strip of land can be used for the cultivation of bananas, etc. Other measures suggested are : the destruction of badly infested coffee trees ; catching the adults in December–January and in August by means of light-traps ; and killing the larvae in their galleries by means of a wire, or by injecting into each entrance hole 10–15 cc. of petrol and immediately sealing it. The injections can be made by means of a copper syringe [xix, 55], or with a specially adapted insecticide sprayer, which is described.

The measures recommended against *A. monacha* are : clean cultivation and burning of all dead wood that may harbour the larvae ; destruction of infested coffee and other trees ; collection of the adults early in the morning ; and the use of light-traps and petrol injections. The artificial spread of the fungus that has been recorded as attacking this Bostrychid [xix, 736] is considered impracticable.

TAKAGI (G.). **Studies on the Methods of Light-attraction in controlling the Pine-moth,** *Dendrolimus spectabilis*, **Butl.** [*In Japanese.*] —*Bull. For. Expt. Sta., Korea*, no. xv, pp. 1–82, 2 pls., 1 map. Keijo, Korea, March 1933. [With a Summary in English.]

The adults of the Lasiocampid, *Dendrolimus spectabilis*, Butl., a pest of pines in Korea [*R.A.E.*, A, xix, 293, etc.], were found to be attracted to any kind of light between 8 p.m. and 5 a.m. The numbers caught in light-traps were affected by such factors as moonlight, wind and the physiological condition of the moths. The traps should be hung as high as possible in the forest in order to attract the females, the males being more attracted to lower ones. The proportion of females caught was much greater in the earlier hours of the night. The trapped females contained an average of about 70 eggs, whereas the average number

contained before oviposition was 438·8. Of the eggs laid by a given female, however, the percentage that hatch is normally higher for those laid later, so that the use of light-traps may be of value in control.

TAKAGI (G.). **On the Volume of Leaves fed on by the Larva of the Pine-moth.** [*In Japanese.*]—*Bull. For. Expt. Sta. Korea*, no. xv, pp. 84–96. Keijo, Korea, March 1933.

The number of pine needles destroyed by a larva of *Dendrolimus spectabilis*, Butl., during its development was found to vary from 212·2 to 621·3, with an average of 422·9. The larvae usually moulted 7 or 8 times, sometimes 9, but very rarely 6.

UCHIDA (T.). **Ueber die Schmarotzerhymenopteren von** *Grapholitha molesta* **Busck in Japan.** [On the Hymenopterous Parasites of *Cydia molesta* in Japan.]—*Insecta Matsumurana*, vii, no. 4, pp. 153–164, 5 figs. Sapporo, Japan, June 1933.

The following Ichneumonids are recorded as parasites of *Cydia* (*Grapholitha*) *molesta*, Busck, and in some cases also of other moths, in Japan : *Phaeogenes japonicus*, Ashm., also reared from *Hemerophila* (*Simaëthis*) *pariana*, Clerck ; *Spilocryptus grapholithae*, sp. n. ; *Habrocryptus yagoi*, sp. n., and *Hemiteles bicolorinus*, Grav., both also from *Kakivoria flavofasciata*, Nagano, a pest of persimmons [*cf. R.A.E.*, A, xii, 350] ; *H. molestae*, sp. n. ; *Ephialtes laspeyresiae*, Uch. [xxi, 88] ; *Pimpla turionellae*, L., also from *Dendrolimus albolineatus*, Mats., *Tortrix* (*Cacoecia*) *sinapina*, Butl., and *Naranga aenescens*, Moore ; *P.* (*Itoplectis*) *epinotiae*, Uch., also from *Enarmonia* (*Epinotia*) *diniana*, Gn. ; *Glypta cymolomiae*, Uch., also from *Argyroploce* (*Cymolomia*) *mori*, Mats. ; *Angitia* (*Dioctes*) *molestae*, Uch. [xxi, 320] ; *Pristomerus vulnerator*, Panz. (of which *P. chinensis*, Ashm., is probably a synonym), also from *Platyedra* (*Gelechia*) *gossypiella*, Saund., and *Argyroploce* (*Cymolomia*) *morivora*, Mats. ; *P. vulnerator* f. *erythrothoracis*, n. ; *Cremastus flavo-orbitalis*, Cam. [xxi, 422], also from *Numonia* (*Nephopteryx*) *pirivorella*, Mats. ; and *Plectochorus*, gen. n. (*Mesochorus*) *iwatensis*, Uch. Those recorded from Korea are *Pimpla turionellae*, *Angitia molestae*, *Pristomerus vulnerator*, *C. flavo-orbitalis* with f. *coreanus*, Uch., and *Hemiteles* (*Nipponaetes*, subgen. n.) *haeussleri*, sp. n.

WATANABE (C.). **On two new Species of Braconidae bred from some Curculionid Larvae in Japan.**—*Insecta Matsumurana*, vii, no. 4, pp. 180–181. Sapporo, Japan, June 1933.

Descriptions are given of *Microbracon* (*Bracon*) *apoderi*, sp. n., reared from *Apoderus balteatus*, Roel., and *Calyptus byctisci*, sp. n., from *Byctiscus venustus*, Pasc., in Japan.

YOKOYAMA (K.) & KUROSAWA (J.). *Spilosoma* (*Diacrisia*) *subcarnea* **Wlk.** [*In Japanese.*]—*J. Seric. Soc.*, iv, no. 2, pp. 96–112, 1 pl. Tokyo, May 1933.

The Arctiid, *Diacrisia* (*Spilosoma*) *subcarnea*, Wlk., all stages of which are described, feeds on the leaves of mulberry in Japan. It has two generations a year, hibernating in the pupal stage in the soil. The adults occur from late April to early June, and again in July–August, the males living for about 5 days, and the females, which lay 200–800

eggs, for about 8. The eggs are deposited on the lower surface of the leaves and hatch in about a week. The larvae, which are at first gregarious, complete their growth in 28–42 days.

Noguchi (T.) & Kawada (K.). **New Insect Pests of Citrus collected in 1930 and 1931.** [*In Japanese.*]—*J. Pl. Prot.*, xx, no. 7, pp. 551–554. Tokyo, July 1933.

Very brief notes are given on 15 insects collected on *Citrus* in the Shizuoka Prefecture, including the Halticid, *Luperomorpha funesta*, Baly, and the Dermestid, *Anthrenus verbasci*, L. The latter attacks the flowers, causing the so-called " injured fruits."

Hori (H.). **The Species and Distribution of the Pterophorids attacking Grape-vines and allied Plants in Japan.** [*In Japanese*, with description of a new species in English.]—*Oyo-Dobuts. Zasshi*, v, no. 2, pp. 64–71, 4 figs. Tokyo, May 1933.

Descriptions are given of the various species recorded, those that attack grape-vines being *Platyptilia ignifera*, Meyr., and *Nippoptilia vitis*, Sasaki. The former occurs in Japan, and the latter, of which *Oxyptilus mycites*, Meyr., and *O. formosanus*, Mats., are synonyms, in both Japan and Formosa, where it also infests wild species of *Vitis*.

Kamiya (K.). **On the Larva and Pupa of** *Sternoplistes temmincki*, **Guér.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, v, no. 2, pp. 72–75, 4 figs. Tokyo, May 1933.

Descriptions are given of the larva and pupa of the Cerambycid, *Sternoplistes temmincki*, Guér., which attacks bamboo in Japan.

Sawa (R.), Teraoka (I.) & Ono (K.). **Observations on the Collecting of** *Anomala* **by Light Traps.** [*In Japanese.*]—*Oyo-Dobuts. Zasshi*, v, no. 2, pp. 76–84. Tokyo, May 1933.

From 25th July to 18th September, 56,714 adults of the Rutelid, *Anomala rufocuprea*, Motsch. [*cf. R.A.E.*, A, xv, 156], of which 55·83 per cent. were females, were caught by means of light-traps in the Ibaragi Prefecture. The beetles were attracted to light throughout the night, but especially about 8 p.m.

Takahashi (R.). **On** *Stephanitis* (*Norba*) *aperta* **Horv.** [*In Japanese.*] —*Bull. Dept. Agric. Govt. Res. Inst. Formosa*, no. 93, 9 pp. Taihoku, Formosa, May 1933.

Camphor [*Cinnamomum camphora*] is attacked by some 20 species of Rhynchota in Formosa, of which the Tingid, *Stephanitis aperta*, Horv., is very common in the lowlands of the Island and is one of the most injurious. It does not kill the tree, but retards its development. All the stages are found throughout the year, during which 7 or 8 generations are produced. The adults live for 22–54 days, and pairing usually occurs 4–5 days after emergence. The eggs, of which one female lays about 200, are deposited on the lower surface of the leaves, mainly along the mid-ribs, and hatch in 14–45 days. The nymphs, which are gregarious and not very active, reach the adult stage in 13–24 days. Descriptions are given of the egg and nymph, with a key for distinguishing the 5 nymphal instars.

SONAN (J.), INAMURA (S.) & SHIRAKI (T.). **Research on the Migratory Locusts in Formosa, and an Account of their Control.** [*In Japanese.*]—*Publ. Bur. Ind. Govt. Formosa,* no. 635, 59 pp., 4 pls. Taihoku, Formosa, March 1933.

There have been several serious outbreaks of *Locusta migratoria migratorioides,* R. & F., at intervals of about 10 years in Formosa. The last one occurred on the island of Samasana (Kashoto), east of Formosa, in 1923, when the work here described was carried out. The locusts, which are not usually found in Formosa and the neighbouring islands, had migrated from the Philippines, where they were also abundant. Many were found in the sea and on the beaches of the islands. In Samasana they fed on rice, sweet potato, ground-nuts and many wild plants, including bamboo, *Miscanthus* and *Pandanus.* The invading swarms oviposited, and hoppers were found in groups at the beginning of July 1923. They reached the adult stage in the middle of that month, and 2 further generations occurred on the island, but all the locusts had died by the middle of January 1924. One egg mass contained 35·6 eggs on an average, and some 24 egg-pods were found to the square foot. In breeding experiments in Taihoku, the life-cycle from egg to adult required 38–52 days, and the adults lived for over 2 months.

SERRANO (F. B.) & PALO (M. A.). **Blossom-blight of Mangos in the Philippines.**—*Philipp. J. Sci.,* l, no. 3, pp. 211–277, 17 pls., 14 refs. Manila, March 1933.

An account is given of the bionomics of the Jassids, *Idiocerus niveosparsus,* Leth., and *I. clypealis,* Leth., which are the most destructive pests of mango (*Mangifera indica*) in the Philippines [*cf. R.A.E.,* A, xx, 472], with brief descriptions of all stages and details of experiments in control. All varieties of mango are apparently attacked with equal severity. *I. niveosparsus* is larger and more destructive than *I. clypealis,* but this is often outweighed by the preponderance of the latter. The eggs of *I. niveosparsus* are laid in the flower stems and flower-buds during the blooming season, and in the mid-ribs of tender leaves in the off-season ; they hatch in 4 days, and the nymphal stage lasts 7½ days. Those of *I. clypealis* are laid exclusively in the flower-buds and hatch in about 4½ days ; the nymphal stage, which is spent entirely on the inflorescence, lasts 9½ days. *I. clypealis* feeds on various other plants, whereas *I. niveosparsus* has been found only on mango.

Natural enemies observed were a fungus, possibly *Isaria* sp., parasitising adults of *I. clypealis,* and several predators, including Coccinellids, ants, and spiders.

Experiments are described in spraying infested trees in February–March, 3 applications being generally made at intervals of about 3 days. Of the various concentrations of nicotine sulphate and soap solution tried, one containing 0·36 per cent. soap and 0·12 per cent. nicotine sulphate was the most efficient on one variety, but on another variety with more delicate flowers, one containing 0·3 per cent. soap and 0·05 per cent. nicotine sulphate was better. In laboratory tests nicotine sulphate alone (0·5 per cent.) killed all nymphs and adults in 11 minutes, soap alone (0·5 per cent.) in 11 seconds, and combinations of 0·5 per cent. soap with 0·025–0·1 per cent. nicotine sulphate in 8–9 seconds. In field trials the greater toxicity of the combined sprays was much more marked ; the relative value of the two treatments will

depend partly on the market price of the fruit. When soap was used alone, a 0·5 per cent. solution was the most effective on the less delicate variety and a 0·4 per cent. solution on the more delicate one, but more frequent applications (sometimes as many as 6) were required with the weaker concentration. The yield of trees of the former variety treated with 0·5 per cent. soap was 4·7 times that of untreated trees, and the cost was about 1*d.* per 10 fruit, whereas the yield from trees sprayed with the first nicotine-soap solution was 5 times that of the control trees, at a cost of 1*d.* per 3 fruit ; it is estimated that the net profit per tree would be nearly 2*s.* greater with the former treatment. Spraying is required when infestation amounts to two or more adults per panicle, and co-operative work is necessary to prevent reinfestation.

Large numbers of the Jassids, particularly *I. niveosparsus*, were caught by means of a light-trap (consisting of a lantern in a large bowl of water on which was a film of kerosene) placed 3–6 ft. above the ground. The trap was most effective on dark nights and might prove useful where lack of water handicaps spraying, or for isolated groves where there is little danger of reinfestation.

GREENSTREET (V. R.) & LAMBOURNE (J.). **Tapioca in Malaya.**—*Gen. Ser. Dept. Agric. S.S. & F.M.S.*, no. 13, viii+76 pp., 24 pls., 43 refs. Kuala Lumpur, 1933. Price 2*s.* 4*d.*

In a section (pp. 42–43) of this bulletin on the cultivation of cassava (*Manihot utilissima*) in Malaya, G. H. Corbett deals with various insect pests, none of which has caused extensive damage. The most important Lepidopterous pest is *Tiracola plagiata*, Wlk., the eggs of which are laid in groups on the lower surface of the leaves and hatch in about 5 days. The larvae, which feed for about 16–18 days and undergo a pupal period of about 10 days in the soil, may migrate from secondary jungle growth to various crops [*R.A.E.*, A, xiv, 557]. They probably cause more damage to castor [*Ricinus communis*] than to cassava and have also been found on lime [*Citrus*], banana and beans. Hand-collection of the eggs and larvae would probably be more economical than spraying with lead arsenate. Placing poisoned food material in ditches has afforded protection against invasion. This Noctuid is attacked by the Tachinids, *Sturmia* (*Blepharipoda*) *ophirica*, Wlk., and *S. inconspicua*, Mg.

Tetranychus telarius, L., is frequently found on the lower surface of the leaves and in cases of severe infestation may cause complete defoliation. It may be controlled by a dust of sulphur and lime, but where only small areas are attacked the infested leaves should be removed and burnt as soon as the mite is observed. Other pests are the Gryllid, *Brachytrypes portentosus*, Licht. (*achatinus*, Stoll), which frequently severs young plants at night and removes them to its burrow, *Valanga nigricornis*, Burm., which occasionally attacks the leaves, the Coccid, *Saissetia nigra*, Nietn., which sometimes infests the leaves and stem and may be controlled by a kerosene emulsion spray, and the Pentatomids, *Megymenum brevicorne*, F., and *Aspongopus* sp., and the Coreid, *Homoeocerus* sp., which have been observed sucking the sap from the young shoots and leaves.

Review of Agricultural Operations in India 1929–30 & 1930–31.—Med. 8vo, v+350 pp., 2 pls., 1 fldg. map. Delhi, Managr. Publ., 1933. Price 8*s.* 3*d.*

A section of this report (pp. 163–174) includes information on work done on insect pests and lac cultivation. A brief account is given of the

recent severe outbreak of *Schistocerca gregaria*, Forsk. [*R.A.E.*, A, xix, 136], which subsided during 1931–32 and is now confined to Sind and Baluchistan, which, perhaps with certain parts of Rajputana, form a permanent breeding ground [*cf.* xix, 415]. In work on pests of sugar-cane [*cf.* xx, 306], it was found that *Pyrilla* lives for about 100 days between November and March and is thus able to survive the winter in the adult stage, and also that it has a variety of food-plants, including wheat, oats, guinea-grass [*Panicum maximum*] and several wild grasses.

The Acridids, *Hieroglyphus banian*, F., and *H. oryzivorus*, Carl, caused serious damage to rice in two areas in Madras, eating the plants down to stalks a foot high in severely infested fields. Good results were obtained by ploughing, where possible, in January–March and scraping the bunds to a depth of 3–4 ins., which dislodged the eggs and brought them to the surface where they were destroyed, but this operation has to be carried out over a large area to be effective. The Delphacid, *Nilaparvata lugens*, Stål, was effectively controlled in rice-fields by applying a film of kerosene to the irrigation water and then jarring the plants ; on the least disturbance, the bugs jumped into the water. A comparative study of the damage caused to different crops of rice by the stem-borer [*Schoenobius bipunctifer*, Wlk.] in the Punjab [*cf.* xix, 53] showed that in that sown early the percentage of infestation varied from 1 to 19, and in that sown late from 38 to 87. A total of 37 borers per 1,000 stems overwintered in the stubble of the first crop, as compared with 352 in that of the second crop. Plants growing in the shade or on low ground were more severely infested.

Large numbers of spotted cotton bollworms [*Earias*] were observed to be attracted to alternative food-plants such as bhindi [*Hibiscus esculentus*] and hollyhock throughout the fruiting season in the Punjab. Preliminary work indicated that the whitefly of cotton [*Bemisia gossypiperda*, Misra & Lamba] is probably not the main cause of cotton failures, though it is a serious pest [*cf.* xx, 554]. Experiments and observations have shown that the only important source of reinfestation of cotton by the pink bollworm [*Platyedra gossypiella*, Saund.] in the United Provinces is the seed, in which the larvae remain dormant between harvest and sowing, adults emerging to oviposit on the growing plants even if the seed is left unsown until the monsoon [*cf.* xviii, 28]. At 140°F., the larvae are killed almost immediately without injury to the seed, and at temperatures as low as 125°F. after prolonged exposure. During the latter part of March and in May–June, the heat of the sun is sufficient to raise the temperature of the seed to the lower lethal point [*cf.* xviii, 462].

Investigations showed that the woolly aphis [*Eriosoma lanigerum*, Hausm.] is a serious pest of apple in the Kumaon Hills.

JARVIS (E.). **Cane Pest Combat and Control.**—*Queensland Agric. J.*, xxxix, pt. 6, pp. 242–244, 3 figs. Brisbane, 1st June 1933.

Notes are given on the effect of moisture, etc., on pupation of larvae of the greyback cockchafer [*Lepidoderma albohirtum*, Waterh.] attacking sugar-cane in Queensland [*cf.* *R.A.E.*, A, xv, 29, 176]. A fungus (green muscardine) often destroys the larvae in April–June. It is suggested that the mummified grubs that have been killed by it should be collected from the plough furrows, and then powdered and thoroughly mixed with moist, finely sifted soil with a high humus

content (1 : 1,000). The mixture should be sprinkled at intervals of 2 or 3 feet as thinly as possible before planting an infested field.

The larvae are also attacked by a bacterial disease, which kills them in about 5 days and is favoured by abnormally wet conditions.

McCarthy (T.). **Insect Pests of Tobacco.**—*Agric. Gaz. N.S.W.*, xliv, pts. 5 & 6, pp. 372–376, 439–442, 6 figs. Sydney, May & June 1933.

Notes are given on the bionomics and control of the following pests of tobacco in New South Wales : *Phthorimaea operculella*, Zell. (tobacco leaf-miner), which feeds under the epidermis of the leaves in the seed-beds, destroying parts of the green tissue and causing transparent blisters ; *Heliothis obsoleta*, F. (tobacco budworm), which attacks the mature foliage and causes serious injury by boring in the young terminal shoots or buds ; cutworms, which sever the young plants at ground level and attack the stems or destroy the foliage of the older ones ; *Listroderes costirostris*, Schönh. (*obliquus*, Gyll.) (tobacco elephant-beetle), the larvae and adults of which may rapidly cause serious damage in the seed-beds, particularly when the plants are comparatively small ; and *Anaphothrips obscurus*, Müll. (*striatus*, Osb.) (tobacco thrips), which damages the leaves by rasping the surface and extracting the sap and also by covering them with excrement.

All these pests are particularly injurious in seed-beds, but much of the damage may be prevented by careful preparation of the beds and the use of suitable insecticides. If attack by cutworms is expected, a bait of 24 lb. bran and 1 lb. Paris green made into a crumbly mash with a solution of 4 oz. salt in 3 gals. water should be applied before or just after sowing. Poisoned vegetation may be similarly used against *L. costirostris* [*R.A.E.*, A, xxi, 24]. Straw is not recommended as a cover, for it harbours the usual pests and encourages general feeders, which destroy a number of the newly germinated plants. While the plants are small, nicotine sulphate should be applied occasionally against small ground insects, and after the first leaves have reached the size of a sixpence, applications of 1 lb. lead arsenate in 40 gals. water or preferably of a 50 per cent. lead arsenate dust should be made for the control of *P. operculella*. After transplanting, the buds of the plants should be treated, as soon as signs of injury by *H. obsoleta* appear, with 1 lb. lead arsenate and 75 lb. maize meal. This may be applied by means of a tin with a finely perforated lid, though with the older plants it may be necessary partly to open the buds, which generally are more tightly folded, and drop a pinch of the mixture into them. At least one application a week is often required to afford protection. A more general treatment of the crop in the field after transplanting is inadvisable, owing to the danger of excess arsenical residue at harvest.

Rolfe (W. A.). **San José Scale. Winter Spraying Experiments at Shepparton.**—*J. Dept. Agric. Vict.*, xxi, no. 7, pp. 324–326, 4 figs. Melbourne, July 1933.

An account is given of one season's experiments in the control of *Aspidiotus perniciosus*, Comst., in a fruit-growing district in Victoria, where since the scale was first discovered 15 years ago, it has increased to such an extent as to constitute a serious danger to the fruit industry. Good commercial control was obtained on pears with winter white oil and lime-sulphur, separately or combined, applied with a spray gun on

1st July 1932 to heavily infested trees, the best results being secured with 2 gals. of a commercial white oil and 5½ gals. lime-sulphur (30°Bé.) in 72½ gals. water. Comparable results were obtained in a second experiment where the materials were applied with spray rods and nozzles on 30th June. A brief account is given of the bionomics of the scale; in Victoria the first brood of young appears in October, and successive broods continue at intervals of about 10 weeks until April or May. It is sometimes necessary to supplement winter treatment by summer oil sprays during the growing season, when the scale reproduces and also infests the fruit. It has been found that high grade white oil sprays, applied during January, February and March at a strength of 2–2½ per cent., are very effective in checking infestation.

French (C.) & Pescott (R. T. M.). **Household Insects and their Control. Insecticides and Fumigants.**—*J. Dept. Agric. Vict.*, xxi, no. 7, pp. 348–352, 4 figs. Melbourne, July 1933.

General recommendations are given for preventive measures against household insects, together with a brief account of fumigants and other insecticides used for their control.

French (C.). **New Records of Plants attacked by Native Insects.**—*Vict. Nat.*, l, nos. 2–3, pp. 47, 56. Melbourne, 1933.

The first of these notes deals with the Pyrrhocorid, *Dindymus versicolor*, H.-S. (harlequin bug), which in recent years has become an important pest in Victoria. It causes serious injury to grape-vines and also attacks apple, fig, pear, almond, raspberry, currant, gooseberry, apricot and peach, as well as many flowering plants and vegetables. It is uncertain what are its natural food-plants, but it breeds readily on the introduced weed, *Malva rotundifolia*, and on hollyhock. The adults have also been observed feeding on dead larvae of the Lymantriid, *Orgyia* (*Teia*) *anartoides*, Wlk., and on old bones, and sometimes enter beehives.

In the second note, the adults of the Melolonthid, *Diphucephala colaspidoides*, Gyll. [*cf. R.A.E.*, A, viii, 410], are stated to be very destructive in Victoria to the foliage of apple, peach, cherry, plum and quince. They also attack rose, hawthorn, *Leptospermum* spp., and wattle [*Acacia*], and the larvae have become serious pests of strawberries, completely destroying the roots.

Thiem (H.). **Beitrag zur Parthenogenese und Phänologie der Geschlechter von *Eulecanium corni* Bouché (Coccidae).** [On the Parthenogenesis and Phenology of the Sexes of *Lecanium corni*.]—*Z. Morph. Oekol. Tiere*, xxvii, no. 2, pp. 294–324, 41 refs. Berlin, 2nd August 1933.

The following is taken from the author's summary: The literature shows that males of *Lecanium* (*Eulecanium*) *corni*, Bch., occur in very variable ratio to the females, no males at all being recorded from England and Denmark. Observations made in central Germany [*R.A.E.*, A, xx, 615] have been confirmed by similar findings in southern Germany. Breeding experiments from the region where bisexual reproduction occurs showed that isolated female larvae develop

and reproduce parthenogenetically. The males are produced bisexually, and their absence is due to parthenogenetic reproduction. The remarkable decrease of males with an increase in altitude [*loc. cit.*] explains the contradictory records in certain districts. In regions where sexual reproduction occurs, food-plants did not influence the occurrence of the males, but their production is affected by extremes of moisture or dryness at the time of their full development or of pairing, owing to their vitality being lower than that of the females.

MILES (M.). **On the Biology of *Niptus hololeucus* Fald.**—*Ent. Mon. Mag.*, lxix, no. 831, pp. 182–186, 1 pl., 1 ref. London, August 1933.

An account is given of breeding experiments in Manchester with the Ptinid, *Niptus hololeucus*, Fald., begun in October 1931 with beetles taken in a local warehouse. The duration of the various stages differed from those recorded in Germany by Marcus [*R.A.E.*, A, xvii, 469]. The egg stage averaged 14–17 days at summer temperatures. Of the larvae (which were bred on linseed cake and bran), those that hatched during the first half of November 1931 completed their growth in about three months, and those that hatched in July 1932 in about two months. In captivity, full-grown larvae tunnelled into pieces of bark or corks and constructed loosely woven cocoons ; when disturbed, they deserted the cocoons, and one larva eventually pupated normally among the particles of bran. In two instances, the prepupal period was observed to last 40 and 77 days, and the pupal 17 and 24. The adult resting period in the cocoon occupied 17–20 days. One female, which paired 11 days and first oviposited about 16 days after emergence, laid a total of 27 eggs over a period of 27 days. Some beetles that emerged in June and November 1932 were still alive in mid-October 1932 and mid-May 1933 respectively ; of the pair isolated for oviposition, the male lived for a period of over 134 days, and the female 69 days.

It appears that there may be two generations in the year, which under natural conditions may overlap. Brief descriptions of the eggs and larvae are given.

SWARBRICK (T.). **The Spraying of Farm Orchards as a Means of Increasing the Cider Fruit Crop.**—*Ann. Rep. Agric. Hort. Res. Sta. Bristol 1932*, pp. 47–65. Bath [1933].

A brief account is given of the bionomics and control of the more important pests and diseases attacking cider apples in farm orchards in England, with a discussion of methods and equipment suitable for use in these orchards, of the cost of treatment, and of the practice of spraying by contract. The author recommends winter spraying with $7\frac{1}{2}$ per cent. tar distillate (or 10 per cent. on trees that have never been sprayed before) as the most essential requirement. When control of apple scab and red spider [*Paratetranychus pilosus*, C. & F.] is desired, a spring wash of lime-sulphur (3 per cent.) should be applied at the "pink bud" stage, with the addition of lead arsenate (4 lb. to 100 gals. water) if Lepidopterous larvae are also present. From data obtained in 1928, 1929 and 1931, the average cost of spraying with a $7\frac{1}{2}$ per cent. winter wash is estimated at about 1*s*. 3*d*. per tree. The combined cost of a winter wash and one application of lime-sulphur should not exceed 3*s*. 6*d*. per tree.

KEARNS (H. G. H.), MARSH (R. W.) & PEARCE (T. J. P.). **Experiments with Combined Insecticide-Fungicide Sprays for Apples. Progress Report.**—*Ann. Rep. Agric. Hort. Res. Sta. Bristol 1932*, pp. 66–85, 7 refs. Bath [1933].

A review of the existing programme of spring and summer sprays against apple pests in England and of the insecticides and fungicides in general use suggests the need for a combined wash incorporating a fungicide, an oil emulsion, a contact insecticide and a stomach poison. Investigations were therefore carried out at Long Ashton in 1932–33, with a view to producing a stable white oil emulsion that could be combined with lime-sulphur, nicotine or an arsenate (or a combination of them) in hard water without injury to foliage.

Of the emulsifying agents tested for compatibility with lime-sulphur, casein gave rise to free oil, and penetrol appeared to give emulsions stable with lime-sulphur only in the presence of large quantities of casein or glue, the physical properties of which are too variable for their use to be recommended. Sulphonated castor oil with the addition of glue produced more stable emulsions when it had not been treated with alkali, but failed to produce one that was stable with lime-sulphur diluted in hard water. Agral S.R. did not give insoluble salts with calcium, but with large concentrations of the latter it tended to produce water-in-oil emulsions, especially in the presence of magnesium, and though the instability was eliminated by the addition of glue or casein or by using a higher percentage of the emulsifier (more than 12 per cent.), it produced emulsion concentrations that were stiff and therefore difficult to dilute, and some sulphur was precipitated when lime-sulphur was added. An emulsion that was stable with lime-sulphur in hard water and easily diluted was made with 5 per cent. sulphite liquor, which is a waste product in wood pulp manufacture, 65–75 per cent. oil and 20–30 per cent. water. Emulsification took place easily if the first addition of oil was moderate. A dilute emulsion (5 per cent. oil) separated slowly on standing, but could be re-emulsified by shaking. A similar but permanent separation occurred when Agral S.R.T., which is more expensive, was used as the emulsifier. The mixed wash had the two properties necessary for combination with a nicotine spray: it was alkaline and the emulsifying agent supplied, in part, the wetting power. Coarsely ground lead arsenate could be included in the mixtures, because it soon ceased to react with the lime-sulphur when the particles became coated with black lead sulphide. The possibility of using basic calcium arsenate as an alternative is considered.

The results are given of field tests with sprays containing lime-sulphur combined with oil (emulsified with Agral S.R.) in 1932. Apple trees that were badly infested with Aphids and *Paratetranychus pilosus*, C. & F. (*Oligonychus ulmi*, auct.) were sprayed in the green flower stage, or a little later, with 2 per cent. emulsified oil (Shell P_2) to which lime-sulphur was added to make a 3 per cent. lime-sulphur spray. Slight scorching of the leaf margins was noted a week later, but no serious damage was done. Many Aphids and larvae of *Tortrix* and *Cheimatobia brumata*, L., were killed after three days, but though after 13 days the Aphids were considerably less numerous than on trees sprayed with lime-sulphur alone, they were not satisfactorily controlled. The development of *P. pilosus* appeared to be less on the oil-sprayed trees. Sprays containing 5 per cent. oil and 3 per cent. lime-sulphur (applied at the green flower stage) or 2 per

cent. oil and 3 per cent. lime-sulphur (at the late pink stage) or 2 per cent. oil and 1½ per cent. lime-sulphur (at the petal-fall stage) also caused slight, temporary scorching.

Of 10 varieties of apple sprayed in 1933 at about the green flower stage with 3 per cent. lime-sulphur and 5 per cent. oil (emulsified with sulphite liquor), only 3 showed slight scorching. At the pink stage, a 3 per cent. lime-sulphur spray combined with 2 per cent. oil withstood 2 wet days and caused no injury. A mixed wash containing 1½ gals. emulsified oil, 1½ gals. lime-sulphur, 3 oz. nicotine, 2 lb. calcium arsenate and 3 lb. lime in 100 gals. caused some defoliation, which was serious on 3 varieties.

A preliminary trial was carried out with a spray, designed to combine the post-blossom scab spray with the nicotine application against the sawfly, *Hoplocampa testudinea*, Klug, containing 1½ gals. lime-sulphur and 8 oz. nicotine in 100 gals. water, with either 2½ lb. Agral I or 1 lb. of a proprietary wetting agent (Lethalate), both of which are more effective than soap and are compatible with lime-sulphur. No spray damage occurred, and scab was controlled as effectively as on trees sprayed with lime-sulphur alone. The percentages of apples infested by *Hoplocampa* were 80 on unsprayed trees and 46 and 35 on those treated with the sprays containing Agral and Lethalate respectively.

KEARNS (H. G. H.) & SWARBRICK (T.). **Further Observations on the Control of the Apple Sawfly,** *Hoplocampa testudinea* **(Klug).**—*Ann. Rep. Agric. Hort. Res. Sta. Bristol 1932*, pp. 90–94, 2 refs. Bath [1933].

Further experiments on the control of *Hoplocampa testudinea*, Klug (apple sawfly) were carried out at Long Ashton in 1932 [*cf. R.A.E.*, A, xx, 550]. The percentage of infested apples was reduced from 41 (on control trees) to 20·3 by a one-solution proprietary pyrethrum emulsion (containing the equivalent of 0·5 per cent. of the dried flowers); to 15·1 by a spray of 2½ lb. finely ground derris root and 10 lb. soft soap in 100 gals. water (rotenone, 0·004 per cent.); to 9·2 by a proprietary wash of derris extract in a rape-oil emulsion at a concentration of 1 per cent. oil; and to 19·8 by a colloidal lead arsenate spray (4 lb. per 100 gals. water with 2½ lb. of Agral I). All these sprays were applied 7 days after petal-fall. Nicotine washes similar to those of the previous year [*loc. cit.*] reduced the infestation to 10·6 per cent., even when applied as late as 12 days after petal-fall. Since the late application was not satisfactory in 1931, the latest time of effective spraying apparently varies from season to season. Owing to variations in the length of the oviposition period, the incubation period and the time between full bloom and petal-fall, it is difficult to determine the optimum time for making one application of a contact insecticide. The greater effectiveness of the nicotine wash and the derris-oil emulsion was due to the fact that they were toxic to larvae in surface burrows as well as to exposed or (in the case of the lead arsenate) to feeding larvae.

KEARNS (H. G. H.) & WALTON (C. L.). *Psila nigricornis* **Meig. as a Pest of Chrysanthemums.**—*Ann. Rep. Agric. Hort. Res. Sta. Bristol 1932*, pp. 95–96, 2 pls. Bath [1933].

Injury to chrysanthemums in the Bristol area, which was severe in one nursery in 1932 and has been observed for several years in others, has been found to be due to *Psila nigricornis*, Mg. Besides feeding on

the roots and partly destroying them, the larvae burrow longitudinally in the outer part of the rootstock and the first few inches of the stem above the soil ; the tissues above the burrows die, and the cuticle and epidermis split, partly exposing the burrows. Extensive injury kills a number of the basal roots, but a slight infestation, although it reduces the vigour of the rootstock, does not prevent the formation of a few shoots suitable for cuttings. All varieties of chrysanthemum are attacked, but the injuries are most serious in late varieties grown in pots. Pupation sometimes occurs in burrows in the stem, and sometimes in the soil. Larvae obtained in February emerged as adults in the first three weeks of May, and flies, probably of a second brood, may be observed in early August.

For control, the application of repellents during oviposition similar to those used against the closely related species, *P. rosae*, F., is suggested [*cf. R.A.E.*, A, xix, 74, 352 ; xx, 405, etc.]. Liberal applications of soot were made to each pot in August and September in one nursery in 1932, and in January the plants were practically free from serious injury. Naphthalene, scattered at the rate of ¼ oz. per 10-inch pot, is likely to prove effective if applied against the second brood flies at 10-day intervals from early August until mid-October. If larval attack is detected before mid-December, it is suggested that a solution of 1 oz. mercury bichloride in 11 gals. water should be applied to the soil (which should be moist to facilitate penetration) at the rate of ½ pint to each 10-inch pot, preferably at the end of September before extensive tunnelling has occurred.

KEARNS (H. G. H.) & WALTON (C. L.). **Experiments on the Control of the Greenhouse Symphylid** (*Scutigerella immaculata*).—*Ann. Rep. Agric. Hort. Res. Sta. Bristol 1932*, pp. 97–101, 4 refs. Bath [1933].

The authors describe experiments carried out on the control of the Scolopendrellid, *Scutigerella immaculata*, Newp., which was recognised as a serious pest of tomatos in England in 1928 [*cf. R.A.E.*, A, xix, 606]. Since naphthalene worked into the soil just before planting did not prove an effective repellent, steam sterilisation of the soil in infested greenhouses [*cf.* xx, 42] was attempted in 1931. In one nursery, where the subsoil was compact and infestation was confined to the top 18 inches of soil, the results were good and a satisfactory crop was grown ; in another nursery the soil was steam-sterilised in early March with apparent success, and a good crop of tomatos was subsequently produced, followed by potted chrysanthemums, which remained undamaged, though a heavy infestation was observed in and below the pots at the end of the season. When the soil from these pots was removed and treated with cresylic acid emulsion, it produced a good crop of tomatos. In February and early March 1932, the soil in the second nursery was again steam-sterilised, but though a second application was made because infestation spread from the subsoil after the first, the subsequent crops still showed signs of attack. This was successfully checked by heavy watering with mercury bichloride solution (1 oz. to 160 gals. water). Steam sterilisation failed because the subsoil in the nursery was loose, and when the temperature of the house was lowered at the end of December, the Scolopendrellids hibernated at a depth of 4–5 feet. For successful sterilisation, they must be attracted to the top layer of the soil, for which purpose cheap lettuce might be grown, when the house is heated.

STANILAND (L. N.) & BEAUMONT (A.). **Ninth Annual Report of the Department of Plant Pathology for the Year ending September 30th, 1932.**—*Pamph. Seale-Hayne Agric. Coll.*, no. 40, 43 pp., 2 figs. Newton Abbot, Devon [1933].

An account is given of about a year's observation on *Myzus ornatus*, Laing, which has recently been found to be a pest of violets in various localities in Devon and Cornwall [*R.A.E.*, A, xx, 257]. Despite severe weather conditions during the spring of 1932 and the following winter and spring, the Aphids were always present on the plants; they were most numerous in January and in June. In February and in July–August 1932, when they were scarce on violets, winged forms occurred, and there were probably extensive migrations to some other food-plant. Spotting of the petals apparently begins as soon as the Aphids are driven into the flowers by the cold east winds in November. The greatest damage was caused to the flowers on the advent of warm weather in the spring, when the Aphids increased in numbers and began to feed on the leaves. The injury appears to be less when the flowers open rapidly, as there is then insufficient time for the petals to become seriously marked. Besides the white or greenish patches on the petals, infested plants are distinguished by a yellowing of the foliage and excessive growth of weak lateral crowns. The runners may be freed from infestation before planting by plunging their tops up and down in an insecticide containing pyrethrum, which in an experiment killed all the Aphids and did not appear to affect the growth of the plants. During late spring or early summer and again just before the beginning of the flowering period about the beginning of September (the latter period being the more important), severely stunted and curled plants should be stripped of all their leaves and lightly infested plants of the lower leaves; they should then receive two applications of nicotine at an interval of a week, either in the form of a spray (6 oz. to 100 gals. water, with sufficient soap to produce a lather) or, under very favourable weather conditions, of a dust. A light attack before the summer migration may not require control, but after the Aphids have returned to the violets in September, a comparatively small number may cause serious injury to the flowers, since cold weather leads to their concentration within them. Once they gain the shelter of the flowers, control measures would seem impossible.

Brief notes are given on insect pests observed to be important factors affecting the yield of broccoli seed in Devon and Cornwall. The eggs of *Ceuthorrhynchus assimilis*, Payk. (turnip seed weevil) are laid in spring on the seed-pods or in the immature seed-vessels, and the larvae feed on the pistils or the unripe seeds. Severely infested pods usually open early, the full-grown larvae falling to the ground and pupating at a depth of about 2 ins. There are probably two generations a year, a variety of crucifers being attacked. Sprays containing derris or pyrethrum, such as are applied without injury to raspberry flowers against the raspberry beetle [*Byturus tomentosus*, F.] [*R.A.E.*, A, xxi, 295, etc.], would probably give satisfactory control. If it occurs in small numbers, *Meligethes aeneus*, F., is probably beneficial in pollinating the flowers [ix, 64], but it is often abundant enough to cause serious loss of seed [*cf.* viii, 542; xv, 580]. Dusting with lead arsenate is reported to be effective, and the measures recommended against *C. assimilis* might be of value. The larvae of *Plutella maculipennis*, Curt. (diamond-back moth) [*cf.* xiv, 594, etc.], damage the leaves and feed on the developing seed-pods, sometimes causing serious

loss. This Tineid is specially abundant in coastal districts. On plants kept for seed, control may be readily obtained by a lead arsenate spray, which will also be of value against the larvae of *Pieris brassicae*, L., and *P. rapae*, L.

A list is given of insects reported from Devon and Cornwall in 1932 but not in the eight preceding years, or occurring on food-plants not previously reported, together with notes on the pests observed during the year. Severe attacks are recorded by the following: *Lema melanopa*, L., on late barley; *Phorbia cilicrura*, Rond. (*Chortophila fusciceps*, Zett.) on French beans; *P.* (*C.*) *brassicae*, Bch., on cruciferous vegetables and wallflowers; *Pentatrichopus potentillae*, Wlk. (*Capitophorus fragariae*, Theo.) and *Tetranychus telarius*, L. on strawberries, and the latter also on violets; *Psila nigricornis*, Mg., on chrysanthemum; and *Erythroneura pallidifrons*, Edw., on tomatos. A slight infestation by the Scolopendrellid, *Scutigerella immaculata*, Newp., was also discovered on tomatos under glass, and *Trialeurodes vaporariorum*, Westw., was found breeding on elm in the field, constituting a continual source of reinfestation of a greenhouse. A larva of *Merodon equestris*, F., was taken in a sample bulb of the dutch iris, an unusual food-plant.

PETHERBRIDGE (F. R.), THOMAS (I.) & HEY (G. L.). **On the Biology of the Plum Sawfly,** *Hoplocampa flava* **L., with Notes on Control Experiments.**—*Ann. Appl. Biol.*, xx, no. 3, pp. 429–438, 1 pl., 7 refs. Cambridge, August 1933.

Though *Hoplocampa flava*, L., was first reported on plums in England in 1926 [*R.A.E.*, A, xv, 365], the authors give evidence to show that all records of damage to plums by *H. fulvicornis*, Panz., in that country should be referred to it. Observations on its bionomics, carried out in several years, showed that the adults emerge from the soil about a week before a variety of plum that flowers in mid-season is in full bloom, the actual date varying from season to season. Upon emergence, they either crawl up the trunks of the trees or fly direct to the fruits. In 1926 (a very early season), they were trapped in muslin cages as they emerged from the soil, and it was found that the curve of emergence followed closely that of temperature; nearly 70 per cent. emerged between 3rd and 6th April (with ground temperatures at 9 a.m. of 40–51°F.), but emergence continued until the 12th, this period probably being longer than normal.

The adults live about 14 days, the females living longer than the males. Of 72 collected in 1932 by shaking the trees, 63 were females. In the cages the females were more active than the males. Both sexes fed on the nectar and pollen of the plum flowers. Pairing appears to take place shortly after emergence, and polygyny was observed in the laboratory. Oviposition occurred 2–3 days after pairing, when the flowers were fully open or beginning to turn brown. Occasionally eggs were deposited in young flowers. Only one egg is laid in each flower [*cf.* xviii, 436], usually in the wall of the receptacle, but sometimes in the tissue of sepals or among the stamens. Besides immature eggs, as many as 50 developed ones were found in females examined. The larval period occupied 33 days; in the first instar, the larvae bored into the developing fruits; in the second, they migrated to other fruits into which they tunnelled, a characteristic odour resembling that of benzaldehyde being given off; and in the third, fourth and fifth instars, they fed on the stones, further migration occurring in the last two. When

full-grown, they dropped to the ground and began immediately to burrow in the soil, soon afterwards forming their cocoons. In an experiment in which numerous larvae were placed on the soil inside vertically embedded drain-pipes, only 12 cocoons were recovered in late July, of which none was found in the top 2 ins. of soil, 4 in the next 3 ins., 7 in the next 4 ins., and 1 in the next 2 ins. The larvae live throughout the winter, and some pupate in the spring about 3 weeks before emergence, but the pre-pupal period may be considerably prolonged, and it is probable that some larvae remain for two winters in the cocoon.

It is suggested that the time of flowering of a given variety of plum may affect the intensity of attack, those flowering in the mid-season being more severely infested.

In 1929, a spray of 4 lb. soft soap and 4 oz. nicotine in 10 gals. water (an extra 2 lb. soap being added owing to the hardness of the water) was applied to plums that were in full bloom on 4th May (mid-season). Trees sprayed on 3rd May showed 2·4 per cent. of damaged fruit, and those sprayed on 10th May 1·8 per cent., as against 11·3 per cent. on the unsprayed trees. In 1932, similar sprays applied 11 and 14 days after the trees were in full bloom had no appreciable effect.

HEY (G. L.) & THOMAS (I.). **On the Biology of *Cacoecia crataegana* Hüb. (Lepidoptera : Tortricidae) on Fruit Trees in the Wisbech Area.**—*Ann. Appl. Biol.*, xx, no. 3, pp. 439–462, 13 figs., 2 pls., 25 refs. Cambridge, August 1933.

An account is given of the results of observations on the bionomics of *Tortrix* (*Cacoecia*) *crataegana*, Hb., made in consequence of the finding of the egg-masses on fruit trees (apple, pear, plum and cherry) in a small area in eastern England in 1930 and subsequent years. This moth is of local occurrence in woods in England, where it attacks a variety of trees, but there appears to be only one previous record of it in orchards in that country. Descriptions are given of all its stages, including each of the five larval instars.

The eggs are laid in masses in slight depressions of the bark on the upper part of the trunk or on the lower branches. They were first noticed in the field on 7th July, and oviposition continued throughout July and August. The winter is passed in the egg stage ; in 1930, the first eggs hatched on 1st May, and in 1931, on 15th April, and larvae were present on the trees till the end of June. The larval period averaged 36 days. In the first and second instars, the larvae fed on the lower surface of the leaves (willow being the food-plant in the laboratory). In the second instar, they were less active and fed under a fine web. In the third, fourth and fifth instars, they fed in rolled leaves. Pupation usually took place inside a rolled leaf or between two leaves webbed together, but some pupae have been observed suspended from a leaf or twig by the hooks on the cremaster. In the laboratory, pupation occasionally occurred in the fourth instar. The pupal period varied from 10 to 31 days. In the field, pupae were found from 1st June to 9th July. In the laboratory, the adults remained hidden among the leaves during the day and became active at night ; pairing was observed within 4 days of emergence, but over a week elapsed before oviposition commenced.

This Tortricid is not of marked economic importance in commercial orchards unless present in large numbers. The ordinary tar distillate

and mineral oil sprays did not increase mortality among the egg-masses, and lead arsenate sprays failed to penetrate the rolled leaves that enclosed the feeding larvae.

Parasites observed were the Ichneumonids, *Phytodietus segmentator*, Grav., and *Pimpla maculator*, F., the Braconids, *Macrocentrus abdominalis*, F., and *Apanteles xanthostigma*, Hal., the Tachinid, *Zenillia* (*Exorista*) *roseanae*, B. & B., and *Trichogramma evanescens*, Westw., apparently the typical form, as distinct from *T. cacoeciae*, Marchal [*cf.* xv, 653]. The life-cycle of *T. evanescens* in the laboratory occupied about a month, so that there may be 4–5 generations a year. It oviposited a few days before the moth larvae were due to hatch, and did not confine its egg-laying to the periphery of the egg-masses as the overwintered generation of *T. cacoeciae* does [*loc. cit.*].

WILLIAMS (C. B.). **Observations on the Desert Locust in East Africa from July, 1928 to April, 1929.**—*Ann. Appl. Biol.*, xx, no. 3, pp. 463–497, 10 figs., 1 pl., 5 refs. Cambridge, August 1933.

In 1928, the author carried out studies on *Schistocerca gregaria*, Forsk., in Kenya, where it produced two generations between May 1928 and April 1929. An account is given of various observations on its bionomics, in particular on the effect of changes in weather on the behaviour of hoppers and adults, as well as on the diurnal sequence of behaviour, with special reference to temperature and sunshine. The direction of flight of swarms was studied, and no regular relation could be found between it and the wind. Dissections of adult females showed that the ovaries were about 11 mm. long while the locusts remained purple-brown in colour. An extensive list of plants eaten or avoided by adults is given, as well as notes on food-plants of hoppers.

The chief natural enemies were *Stomatorrhina lunata*, F., which parasitised the egg-pods in various localities in Kenya and was present in enormous numbers in a district in which the locusts had not previously oviposited for at least 10 years; and *Sphex aegyptius*, Lep., which attacked the adult locusts at Amani (Tanganyika) as soon as they arrived there early in 1929 and was observed to migrate in large numbers with the swarms. Many thousands of starlings (*Perissornis carunculatus* and *Spreo superbus*) were seen feeding on the hoppers, but, in spite of their numbers, they did not appreciably affect the size of the bands.

The adult locusts proved to be insensitive to the banging of tin cans or the firing of a gun, but were frightened by the noise of a file drawn down the edge of a saw. It was found that railway lines could not be successfully cleared of locusts that had settled on them by any system of brushes in front of the wheels of the engine, and it is recommended that men should run at short intervals in front of trains to frighten the locusts off the line. A few small-scale experiments with poisoned bran baits showed sodium arsenate and sodium fluosilicate to be equally effective.

BARNES (H. F.). **A Cambium Miner of Basket Willows (Agromyzidae) and its Inquiline Gall Midge (Cecidomyidae).**—*Ann. Appl. Biol.*, xx, no. 3, pp. 498–519, 12 figs., 2 pls., 18 refs. Cambridge, August 1933.

The literature on Agromyzid cambium miners is briefly reviewed, and descriptions are given of all stages of *Dizygomyza barnesi*, sp. n. (that of the adult being by Hendel) and of the anatomy of the larvae. This

Agromyzid has been reported from various parts of England on *Salix* spp., especially *S. viminalis*. In Hertfordsire, the adults emerged from about 21st May until the end of June and lived in captivity about a week. The eggs were deposited about 10–12 ins. from the ground in one-year-old shoots, a single egg being laid in each puncture. The larvae hatched after 1–2 weeks and began to tunnel in the cambium, their activities being confined to the basal part of the rods, the stub and the roots. The rods are rendered useless for basket-making, and the tunnels are subject to secondary attack by bacteria and insects. The injury, which is not easily noticed unless infestation is severe, is most apparent in August and September when the rods are peeled. Pupation took place in the top few inches of soil, and the puparia remained there until the spring. Only one annual generation was observed. The Braconids, *Symphya ringens*, Hal., and *S. hians*, Nees, are recorded as primary parasites, but they are not of great importance in the control of the fly.

Descriptions are also given of the gall-midges, *Profeltiella vespicoloris*, sp. n., a single female of which was obtained in Hertfordshire from a pot of soil in which *Dasyneura arabis*, Barnes, was being reared on *Arabis albida*, and *P. dizygomyzae*, sp. n. The larvae of the latter live as inquilines in the burrows made by *Dizygomyza barnesi*. They form cocoons in August–September within the burrows, but do not pupate until the following year, the pupal stage lasting about 8 days. The adults usually emerge in July, but in the laboratory, emergence took place spasmodically between 26th January and 27th May. There was only one brood a year. At present this Cecidomyiid is only known in *S. viminalis*. It is parasitised by the Scelionid, *Ectadius craterus*, Wlk.

DOWDEN (P. B.). *Lydella nigripes* **and** *L. piniariae*, **Fly Parasites of certain Tree-defoliating Caterpillars.**—*J. Agric. Res.*, xlvi, no. 11, pp. 963–995, 6 figs., 19 refs. Washington, D.C., 1st June 1933.

This is a detailed account of laboratory observations in Hungary during 1929–31 on the bionomics of the Tachinids, *Lydella nigripes*, Fall., and *L. piniariae*, Htg., which are widely distributed in Europe. A consignment of *L. piniariae* from Poland was imported to Massachusetts in 1928 for liberation against *Porthetria dispar*, L., and *Nygmia phaeorrhoea*, Don., as it was not then distinguished from *L. nigripes*, of which it has been generally regarded as a synonym in the literature. The author's experiments, however, show that it is a distinct species. It was able to complete development only in *Bupalus piniarius*, L., the Noctuid, *Abrostola tripartita*, Hfn., and *Tortrix dumetana*, Treitschke, whereas *L. nigripes* has a wide range of hosts, lists of which are given from European literature and from rearings in Europe made in connection with the present study. The economic importance of both Tachinids is discussed, and detailed descriptions of all stages are given. The two species are very similar, and the adults show little difference in behaviour. Under laboratory conditions they lived for an average of 38·9–73·7 days when fed on sugar and honey solution, and for 6·5–9 days on water alone. Cross-mating (with almost sterile progeny) was obtained with difficulty in the laboratory, but is probably rare in nature. Both species deposit living larvae inside the host larvae after first puncturing the skin ; a female of average size produces 125–150 larvae. *L. nigripes*, although preferring hairless larvae, attacks many species of hairy caterpillars, and more than one larva can develop in the

same host. *L. piniariae* practically refuses to attack hairy larvae, and though it is not uncommon to find several larvae in one host caterpillar in the autumn, the author never reared more than one from a host pupa in the spring.

There are three and often four annual generations of *L. nigripes* in different host species. The larvae hibernate in the second instar within the mid-gut of the host larvae or pupae and come out to pupate in late April or early May, the adults emerging soon after. *P. dispar* and *N. phaeorrhoea* must be among the first hosts attacked by the flies of the overwintered generation, for puparia were recovered from these species in the last week of May and early in June. The duration of the larval stage varies with the temperature, size of host, etc.; in the laboratory it ranged from 10 days in *Vanessa urticae*, L., to 50 in retarded larvae of *P. dispar*.

L. piniariae probably completes as a rule only one generation a year, in the larvae of *B. piniarius*, which it attacks during the summer. Winter is passed in the first instar within the host pupa. Puparia did not appear from collected host pupae until the latter part of May or early in June. Apart from one instance of complete development in *T. dumetana* and one in *A. tripartita*, larvae deposited in other hosts never developed beyond the first instar.

The full-grown larvae of both species leave the host and burrow into the ground to pupate at an average depth of 0·5–1·2 ins., the pupal stage usually lasting about 11 days for males, and 12 for females.

A brief comparison is made between *L. nigripes* and *Compsilura concinnata*, Mg., a parasite of *P. dispar* and *N. phaeorrhoea* that has been successfully established in the United States. The bionomics of the two Tachinids are remarkably similar. In competition, the former species was generally the stronger of the two, but both parasites sometimes developed in the same host larva. *C. concinnata* readily attacks almost any species of host larva whether it is hairy or not, and the larvae are hardier than those of *L. nigripes*. The latter's wide range of hosts also decreases its value as a parasite of *P. dispar*. Moreover, a large percentage of the larvae deposited in late autumn complete development so late that there are no host larvae available. It was not ascertained whether *L. nigripes* is attacked by hyperparasites, but there are old records of *Monodontomerus aereus*, Wlk., reared from the pupae.

L. piniariae is much more effective, the percentage of parasitism of *B. piniarius* being often very high. The chief limiting factor is the hyperparasite, *Mesochorus politus*, Grav., which attacks the Tachinid within the host [*R.A.E.*, A, xi, 454]; in 1930, 299 of this Ichneumonid emerged from 600 puparia.

Symposium on Insecticides.—*Industr. Engng. Chem.*, xxv, no. 6, pp. 616–644, 3 figs., many refs. Easton, Pa., June 1933.

In addition to the two papers noticed below, this series, in which various insecticide problems are reviewed from the literature and discussed, includes the following: Removal of poisonous Spray Residues on Fruit, by R. H. Robinson (pp. 616–620), which gives an account of the most recently developed washing equipment and cleaning agents; Poisonous Spray Residues on Vegetables, by W. B. White (pp. 621–623), which records cases of danger to health involved in the excessive use of arsenic, fluorine and lead in insecticides and discusses the question of protective legislation; Significance and Danger of Spray Residue, by C. N. Myers, B. Throne, F. Gustafson and

J. Kingsbury (pp. 624–628), which gives a historical survey of the literature on spray residue dangers and arsenical poisoning of various types, including that following consumption of sprayed foodstuffs, and data on the examination of such foodstuffs for the determination of arsenic and lead ; and Control of Insects on Plants by Chemical Means, Recent Developments, by E. B. Alvord and H. F. Dietz (pp. 629–633).

R. C. Roark (pp. 639–642) gives data concerning the chemical structure of rotenone and its toxicity to insects, etc., enumerates plants of which it is known to be a constituent [*R.A.E.*, A, xxi, 99, 321, 469], and briefly discribes the cultivation of derris and a method of assaying plant material for rotenone content. In a paper entitled Commercial Aspects and future Possibilities of Rotenone, R. W. Birdsall (pp. 642–644) discusses the sources of supply of derris and the method of extracting the product used in spray mixtures [xviii, 689]. The products and derivatives of derris root now on sale are enumerated, and the percentage of rotenone and the total ether extract found in numerous samples of commercial derris, cubé [*Lonchocarpus*] and timbo [*Serjania*] roots is shown. It has been proved that rotenone can be held in solution in hydrocarbon oils with the aid of certain solvents and that the addition of rotenone does improve the usual pyrethrum fly-spray [*cf.* B, xxi, 35]. The results obtained in exhaustive tests of rotenone-pyrethrin combinations, carried out over a period of 10 months, show that when combination concentrates are overdiluted the mortality effected does not decrease to a degree corresponding to the decrease in toxic content. The keeping qualities of ground derris root and derris extracts, and the extent to which handling them may be injurious to health are discussed.

GNADINGER (C. B.). **Selenium. Insecticide Material for controlling Red Spider.**—*Industr. Engng. Chem.*, xxv, no. 6, pp. 633–637, 12 refs. Easton, Pa., June 1933.

Control measures in use against Tetranychid mites in the United States are briefly discussed, the species involved including *Tetranychus telarius*, L., which has nearly 200 known food-plants, and causes losses estimated at £400,000 a year to the cotton crop ; *T. pacificus*, McG., which has caused enormous damage to vineyards in California [*cf. R.A.E.*, A, xviii, 587] and to certain deciduous fruit trees [xvii, 717 ; xix, 420, 495] ; *Paratetranychus pilosus*, C. & F., an important orchard pest along the north-western Pacific coast [xvii, 390] ; *P. citri*, McG., which attacks *Citrus* ; and *Bryobia praetiosa*, Koch, which is common on fruit trees. Since none of these measures has proved entirely satisfactory, tests were carried out with selenium, which is closely related to sulphur and forms analogous compounds. The compound best suited for greenhouse plants was found to be selenium dissolved in potassium ammonium sulphide solution in proportions corresponding to the formula $(KNH_4S)_5Se$. A 30 per cent. solution of this material, designated Selocide, was submitted to a large number of tests against different mites. At a dilution of 1 : 200 with 0·4 gm. soap per 100 cc., it controlled *T. telarius* without injury to tender greenhouse plants, and in outdoor spraying experiments in the spring of 1932 *P. citri*, *B. praetiosa* and certain rust mites [? *Phyllocoptes*] on *Citrus*. Injury caused to stone-fruit trees in tests for tolerance was probably due to the effect of sunlight on the spray residue. J. F. Lamiman obtained kills of 95–100 per cent. of *T. pacificus* on vines in California with Selocide used at dilutions as low as 1 : 800, which the author had

found entirely ineffective in the greenhouse. In experiments in the autumn of 1932 against *Paratetranychus citri* on *Citrus* in California, it was tried with different spreaders and in combination with oil or lime-sulphur, dilutions of 1 : 500 and 1 : 600 being used. The best results were obtained with a combination of Selocide (1 : 600) and a light medium spray-oil of 70 viscosity (1 : 300) emulsified with blood albumen [*cf.* xix, 217] (4 oz. in 100 U.S. gals.), which killed 99·4 per cent. of the older stages, but was less effective against the eggs. It is believed that such a combination can be applied at any time without injury to the trees.

Compounds of tellurium were also tried, but they were not as toxic, as stable, or as easily prepared as those of selenium.

The toxicity of selenium spray residue is discussed [*cf.* xxi, 517]. The toxic action of the selenites and selenates is similar to that of the arsenites and arsenates. When Selocide is diluted 1 : 500, the spray solution contains 0·01 gm. selenium per 100 cc., whereas the arsenate spray ordinarily used contains 0·05 gm. arsenic per 100 cc. As Selocide would be applied only once or twice a year, as compared with the 4–9 applications of an arsenate, it is probable that it would be much less dangerous than arsenical sprays even if all the selenium in the spray residue were oxidised to selenite, which is not the case.

MURPHY (D. F.) & PEET (C. H.). **Insecticidal Activity of Aliphatic Thiocyanates II. Mealy Bug.**—*Industr. Engng. Chem.*, xxv, no. 6, pp. 638–639, 1 ref. Easton, Pa., June 1933.

Further tests of the insecticidal effectiveness of an aliphatic thiocyanate [*R.A.E.*, A, xx, 294] were carried out with *Pseudococcus citri*, Risso, in Pennsylvania. A single thorough application of the insecticide was made upon heavily infested potted plants by means of a small hand sprayer, and 24 hours later the mealybugs were examined. The stock emulsions were made by dissolving the compound in an emulsifying agent and vigorously mixing with a small amount of water and a spreader. The average percentages of mealybugs killed by a 0·125 per cent. solution of the aliphatic thiocyanate were 97·2 with 0·25 per cent. anhydrous soap (potassium stearate) as a spreader, 93·6 with 0·5 per cent. penetrol, and 94·88 with 0·1 per cent. penetrol. The same concentration was sufficient to kill the eggs of *P. citri*.

FRIEND (R. B.) & WEST, jr. (A. S.). **The European Pine Shoot Moth (*Rhyacionia buoliana* Schiff.) with special Reference to its Occurrence in the Eli Whitney Forest.**—*Bull. Sch. For. Yale Univ.*, no. 37, v+65 pp., 11 figs., 9 pls., 4 pp. refs. New Haven, Conn., 1933. Price *Cts.* 50.

A detailed account is given of preliminary work in Connecticut during 1931 and 1932 on the bionomics and control of *Rhyacionia buoliana*, Schiff. (European pine shoot moth) and the effect of its depredations on stands of red pine (*Pinus resinosa*) [*cf. R.A.E.*, A, xxi, 98, 233, etc.]. All stages of this Tortricid are described, and its systematic position, distribution and incidence, and the species of pines attacked, which include many of the more important timber trees in Europe and North America, are discussed. The adults do not fly far, and both sexes are about equally common. The eggs are laid over a period of 1–5 days, beginning 1–2 days after emergence under favourable conditions, on the twigs near the tip and on the sheaths of the needles of red pine, Scots pine (*P. sylvestris*) or white pine (*P. strobus*) indiscriminately. A mature female was found to contain about 480 eggs ;

the greatest number laid in the laboratory was 210. Most of the second-instar larvae found late in July were attacking the buds, but larvae have been discovered as late as February still at the base of the needles, where they probably hibernate. Observations indicate that on red pine the larva usually confines its attack to one bud only in the summer and autumn [*cf.* xx, 650]. Injury to the buds results in a flow of pitch [*cf.* xix, 652], which hardens into a white mass, beneath which the larvae may hibernate.

The following is largely taken from the authors' summary: *R. buoliana* was apparently introduced into the Eli Whitney Forest some time before 1925. Infestation is scattered and spreads slowly; it is not connected with the quality of the site, as reflected in the condition of the trees, though those in better positions are more resistant to attack. With one exception in Scots pine, all cases of serious infestation are in pure or mixed stands of red pine. On individual trees, infestation is largely concentrated in the upper three branch-whorls and in the terminals [*cf.* xxi, 233]. The injury caused in the spring is more obvious than that caused in the autumn. Common signs of heavy infestation are bushy tips produced by the development of adventitious shoots, which may occur so prolifically that no increase in height takes place, and permanent deformation resulting from injury to the sides of terminals that recover.

The growing of trees under the cover of hard-woods (birch, ash, etc.) is not considered practical, as although the trees under shade were freer from infestation, they were greatly suppressed and became infested on the removal of the cover. Mixed plantings are recommended only because a crop may be obtained from the species other than red pine, if the latter is severely damaged. The final result of severe outbreaks is frequently the destruction of the stand as an economic unit. There is no indication that an infestation will normally decline in stands of young red pine before serious injury has been caused.

Parasites of the larvae reared were :—*Ephialtes* (*Calliephialtes*) *comstocki*, Cress., *Hyssopus thymus*, Gir., *Microbracon gemmaecola*, Cushm., *Habrocytus thyridopterigis*, How., *Pimpla* (*Epiurus*) *indagatrix*, Cress., *Eurytoma tylodermatis*, Ashm., and *Chelonus* sp., which with the exception of the last-named have all been recorded from *R. frustrana*, Comst. (Nantucket pine moth) [xvi, 141]. *Trichogramma minutum*, Riley, was bred from the eggs [xxi, 234]. The extent to which indigenous natural enemies and those that may be imported from Europe will affect the abundance of *R. buoliana* is problematical. The trees should be inspected annually, and where they are not over 7 ft. high, the damaged tips should be removed while the infestation is light. Clipping should, however, be delayed until May, when the tree has begun growing and before the adults have emerged, because the injury is most obvious at this time and the winter mortality has reduced infestation. If clipping is necessary in autumn, it should be carried out when the dead needles are visible and before they fall. Except on lightly infested trees, where it is designed to check the spread of infestation, this method is too costly; heavily infested trees should be cut and burned. The destruction of foci of infestation is an essential feature of control and should be carried out to prevent further spread. Field and laboratory experiments indicated that a combination of summer oil and lead arsenate [xxi, 234], applied 3 times at 10-day intervals beginning in mid-June, may be effective on ornamental plantations.

Papers noticed by Title only.

Morstatt (H.). **Bibliographie der Pflanzenschutzliteratur. Das Jahr 1932.** [A Bibliography of Plant Protection Literature in 1932.]—Imp. 8vo, iv+259 pp. Berlin, P. Parey; J. Springer, 1933. [*Cf. R.A.E.*, A, xx, 440.]

La Forge (F. B.), Haller (H. L.) & Smith (L. E.). **The Determination of the Structure of Rotenone.**—*Chem. Rev.*, xii, no. 2, pp. 181–213, 50 refs. New York, April 1933.

Hodge IV (C.). **Growth and Nutrition of** *Melanoplus differentialis* **Thomas (Orthoptera: Acrididae) I. Growth on a satisfactory mixed Diet and on Diets of single Food Plants.**—*Physiol. Zool.*, vi, no. 3, pp. 306–328, 8 graphs, 25 refs. Chicago, Ill., July 1933.

Flint (W. P.) & Larrimer (W. H.). **The Chinch Bug** [*Blissus leucopterus*, Say] **and how to fight it.**—*Fmrs' Bull. U.S. Dept. Agric.*, no. 1498 revd., 16 pp., 6 figs. Washington, D.C., March 1933. [*Cf. R.A.E.*, A, xiv, 532.]

Frison (T. H.) & Ross (H. H.). **A new Species of** *Thripsaphis* **from Illinois (Aphidae, Homoptera).**—*Canad. Ent.*, lxv, no. 7, pp. 152–154, 8 figs. Orillia, July 1933.

Moulton (D.). **The Thysanoptera of South America (III).**—*Rev. Ent.*, iii, fasc. 2, pp. 227–262, 1 fig. Rio de Janeiro, 20th July 1933. [*Cf. R.A.E.*, A, xxi, 320.]

Muramatsu (S.). **On** *Janus piri*, **Okam. et Muram., a Pest of Pear** [in Korea]. [*In Japanese.*]—*J. Pl. Prot.*, xx, no. 7, pp. 537–544, 4 figs. Tokyo, July 1933. [*Cf. R.A.E.*, A, xiii, 400.]

Marumo (N.). **Studies on Rice Borers. I. Classification of the Subfamily Crambinae in Japan.** [*In Japanese.*]—*Minist. Agric. For. Japan Dept. Agric. Nojikairyoshiryo*, no. 52, [75] pp., 3 figs., 6 pls. Tokyo, March 1933. (With a Summary in English.)

Kanda (S.). **A new Species of the Genus** *Eriococcus* [*E. azumae*, sp. n., on bamboo]. [*In English.*]—*Insect World*, xxxvii, no. 5, pp. 151–153, 4 figs. Gifu, May 1933.

Ramakrishna Ayyar (T. V.). **A new Chalcid with branched Antennae from South India** (*Tetracnemus indicus*, **sp. nov.**) [bred from *Pseudococcus citri*, Risso].—*Rec. Ind. Mus.*, xxxiv, pt. 3, pp. 287–288, 1 fig., 2 refs. Calcutta, September 1932. [Recd. Sept. 1933.]

André (M.). **Note sur un Tétranyque** [*Tetranychus* (*Eotetranychus*) *neocaledonicus*, sp. n.] **nuisible au Cotonnier en Nouvelle-Calédonie.**—*Bull. Mus. Hist. nat.*, (2) v, no. 4, pp. 302–308, 4 figs. Paris, April 1933. [Recd. August 1933.]

Symes (C. B.). **The Black Maize Beetle** (*Heteronychus licas*, **Klug**). **Observations on Life History and Control.**—*Rhod. Agric. J.*, xxx, no. 8, pp. 616–643, 1 fig., 1 diag., 1 pl. Salisbury, Rhodesia, August 1933. [*Cf. R.A.E.*, A, xiii, 350.]

[Printz (Ya. I.).] Prinz (J.). **Der Julikäfer** *Polyphylla olivieri* **L. als Rebschädling in Transkaukasien.** [*P. olivieri*, Lap., as a Pest of Grape-Vines in Transcausasia.]—*Anz. Schädlingsk.*, ix, no. 8, pp. 97–104, 4 figs. Berlin, August 1933. [*Cf. R.A.E.*, A, xxi, 9.]

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The Institute will be greatly indebted to readers who may be able to supply any of the following, which should be sent to the Assistant Director, Imperial Institute of Entomology, 41, Queen's Gate, London, S.W.7.

ANNALS OF THE QUEENSLAND MUSEUM (BRISBANE). Nos. 1, 5 and 6 (1891–)
ANNUAIRE ET MÉMOIRES DU COMITÉ D'ETUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (GORÉE) : Vols. I-II (1916–17).
AGRICULTURAL JOURNAL, DEPARTMENT OF AGRICULTURE, BRITISH COLUMBIA (VICTORIA) : Vol. I (1916). Nos. 1 and 2.
AGRICULTURAL NEWS (BARBADOS) : Nos. 1, 25, 26, 34, 66 (1902–04).
ARCHIVES DE L'INSTITUT PASTEUR DE TUNIS :
1906–09 ; 1910, fasc. i–iii ; 1911, fasc. iii–iv.
ARCHIV FÜR SCHIFFS- UND TROPEN-HYGIENE (LEIPZIG) :
Bd. XVII (1913). Hefte, 9, 13 & 14.
ARQUIVOS DO INSTITUTO BACTERIOLOGICO CAMARA PESTANA (LISBON) :
Vols. I–II (1906–10). Vol. III (1911–12) No. 1.
THE BEE WORLD (BENSON, OXON) : Vols. I–II (1919–21).
BIOLOGICAL BULLETIN OF THE MARINE BIOLOGICAL LABORATORY (WOODS HOLE, MASS.) :
Vols. I–II (1899–1901) ; XXIII (1912) ; XXIV (1912) No. 2 ; XXV (1913) Nos. 5–6 ; XXVI (1914) Nos. 1–2 ; XXVII (1914) No. 4 : XXVIII (1915) No. 1 ; XXIX (1915) No. 5 ; XXX (1916) Nos. 2–3 ; XXXI (1916) Nos. 4 & 6 ; XXXII–XXXIII (1917) ; XXXIV (1918) Nos. 1–4, & 6 ; XXXV (1918) ; XXXVI (1919) Nos. 2–3 ; XXXVII (1919) Nos. 4 & 6 ; XXXVIII (1920) Nos. 1, 2, 5 & 6 ; XXXIX (1920) Nos. 4–6 ; XL (1921) Nos. 1–4, & 6 ; XLI (1921) Nos. 2 & 3 ; XLII (1922) Nos. 1–3.
BOLETIN DE LA DIRECCION DE ESTUDIOS BIOLOGICAS (MEXICO) :
Tomos I–II (1924–25).
BULLETIN DU COMITÉ D'ETUDES HISTORIQUES ET SCIENTIFIQUES DE L'AFRIQUE OCCIDENTALE FRANÇAISE (PARIS) : Année 1919, No. 1.
BULLETIN AGRICOLE DE L'ALGÉRIE—TUNISIE—MAROC (ALGIERS).
Année XX (1914). Nos. 7–9, 12–14 and Title-page.
CALIFORNIA AGRICULTURAL EXPERIMENT STATION (BERKELEY, CAL.) :
Circulars 14 and 42 (1905–09).
CANADA : DEPARTMENT OF AGRICULTURE : EXPERIMENTAL FARMS :
Fletcher (J.). Reports of the Entomologist and Botanist for the Years 1886 and 1888. (Ottawa, 1887–89).
CHACARAS E QUINTAES (SÃO PAULO) : Indices to Vols. X, XI, XII and XIV.
COMPTES RENDUS DES SÉANCES DE L'ACADÉMIE D'AGRICULTURE DE FRANCE (PARIS) : Tome VIII (1922) No. 5.
EGATEA, REVISTA DA ESCOLA DE ENGENHARIA DE PORTO ALEGRE, BRAZIL :
Vols. I–VI (1916–21) ; VII (1922) Nos. 1–5 ; VIII (1923) Nos. 2–5 ; IX (1924) Nos. 1, 4–6.
ENTOMOLOGICA AMERICANA (BROOKLYN, N.Y.) :
Vol. IV (1888) Title-page. Vol. V (1889), Nos. 2, 3, 5–12 and Title-page and Index.
ENTOMOLOGISCHE LITTERATURBLÄTTER (BERLIN) : 6 Jahrg. (1906). Nos. 2 & 10.
EXPERIMENT STATION RECORD (WASHINGTON, D.C.) : Vols. I–IV (1889–94).
GEORGIA STATE BOARD OF ENTOMOLOGY (ATLANTA) :
Bulletin : 2, 6, 22 and 28. Circular : 1 to 4, 12, 15 to 18 and 20.
GRASSI (B.) et al. Contributo alla conoscenza delle Filloserine ed in particolare della Fillossera della Vite. (Rome, 1912).
INDIA : FOREST RESEARCH INSTITUTE (DEHRA DUN).
Indian Forest Records : Vol. I, pts. i and iii.
Forest Bulletin (Old Series) : Nos. 1–3.
Forest Leaflet (Zoology Series) : Nos. 1–2.
INDIAN MEDICAL GAZETTE (CALCUTTA) :
Vol. L (1915) No. 10 ; LI (1916) Nos. 1–7, 10 ; LII (1917) No. 7 and title-page & index ; LIII (1918) ; and LIV (1919) No. 2.
INDIANA : Third Annual Report of the State Entomologist, 1909–10.
JOURNAL OF THE BOARD OF AGRICULTURE OF BRITISH GUIANA (DEMERARA) :
Vol. III (1909–10) No. 1. Title pp. and Indices to Vols. I–II.
JOURNAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE (WYE, KENT) :
Nos. 1–6, 8, 10–13, 17–21 (1895–1912).
KENTUCKY AGRICULTURAL EXPERIMENT STATION (LEXINGTON, KY.) :
Bulletin Nos. 21 (1889), 31 (1890), 47 (1893), 53 (1894), 71 (1898) and 91 (1901).

CONTENTS.

Paillot (A.). **L'infection chez les insectes. Immunité et symbiose.**—Med. 8vo, 535 pp., 279 figs., 50 pp. refs. Trévoux, 1933.

It is suggested that the unsuccessful results obtained in attempts to utilise insect diseases in the control of pests may have been due to insufficient knowledge of the pathology of invertebrates. For this reason, investigations on the subject were begun in 1912, and the information so far obtained forms the subject matter of this monograph.

The first four sections of the work deal with diseases caused by protozoa, fungi, viruses and bacteria, the fifth with anti-bacterial immunity and the sixth with symbiosis in Aphids (the only group in which this subject has been studied). The seventh comprises a review of the attempts made to utilise fungi or bacteria for the control of insect pests, and a summary of the part played by Arthropods in the transmission of diseases of man and animals. Author and subject indices are appended.

O'Connor (B. A.). **Entomological Notes.**—*J. Dept. Agric. W. Aust.*, (2) x, no. 2, pp. 228–229. Perth, W. A., June 1933.

Examination has shown that in Western Australia, as in New South Wales [*R.A.E.*, A, xx, 601], the white wax scale attacking *Citrus* is *Ceroplastes destructor*, Newst., and not *C. ceriferus*, And. An Encyrtid parasite, which since its introduction in 1910 has effectively controlled *Lecanium* (*Eulecanium*) *persicae*, F., an injurious pest of vines, mulberry and stone-fruit trees at the beginning of the century, has now been identified as *Aphycus timberlakei*, Ishii [xii, 465]. In May 1933, the Aphid, *Fullawayella* (*Rhopalosiphum*) *violae*, Perg., was found on violet, this being apparently the first record of its occurrence in Australia.

Newman (L. J.) & O'Connor (B. A.). **Insect Pests of Fruit Trees and their Control.**—*J. Dept. Agric. W. Aust.*, (2) x, no. 2, pp. 243–250. Perth, W.A., June 1933.

Notes are given from the literature on the methods of controlling insects attacking fruit trees, and the materials recommended and the times of application against the more important pests of various fruit trees and vines in Western Australia are tabulated. Another table and a chart show the compatibility of the sprays.

French (C.). **New Records of Plants attacked by Native Insects.**—*Vict. Nat.*, l, no. 4, p. 91. Melbourne, August 1933.

This paper, which is one of a series [*cf. R.A.E.*, A, xxi, 554], deals with the Lasiocampid, *Pinara cana*, Wlk. Its natural food-plant in Victoria is *Acacia*, but it is very destructive to the fruit-spurs and leaves of apples and pears. When fully grown, the larvae spin white cocoons between the leaves, half of a leaf being usually drawn over the cocoon. Ichneumonids of the genus *Lissopimpla* help in keeping the moth in check.

EASTWOOD (H. W.). **Bunchy Top Control. Early Identification, Eradication of infective Aphids, and Destruction of diseased Stools.** —*Agric. Gaz. N.S.W.*, xliv, pt. 8, pp. 611–614, 1 fig. Sydney, 1st August 1933.

Recommendations are given for the control of the Aphid [*Pentalonia nigronervosa*, Coq.] that transmits bunchy-top disease of bananas in New South Wales [*cf. R.A.E.*, A, xviii, 31]. Diseased stools should be treated with undiluted power kerosene, which is more effective than a refined grade. If colonies of Aphids have congregated at the funnel leaf or pseudo-stem, applications should begin at these points and then, commencing at ground level, should continue up the barrel of the pseudo-stem, all leaves and particularly the leaf axils and funnel leaf being thoroughly sprayed. The sheaths of the old leaves should be pulled away, and it is often necessary to unfurl the leaf funnel to spray inside. After this, the stool should be removed and destroyed, and the remains on the ground may then receive a second application. The practice of pouring the kerosene down the funnel of the infected plant [*cf. loc. cit.*], apart from contravening present regulations, only kills a percentage of the Aphids.

Healthy plants on which Aphids are present may be thoroughly sprayed at high pressure with a well-mixed emulsion of kerosene. An extension rod facilitates application, particularly when it is necessary to spray down into the centre of well-grown plants. Frequent and regular inspections of all stools on a plantation are necessary for the discovery of the disease and the immediate application of control measures.

WEDDELL (J. A.). **Termites (White Ants).**—*Queensland Agric. J.*, xl, pt. 1, pp. 20–24, 2 figs. Brisbane, 1st July 1933.

A brief description is given of the bionomics of mound-building and dry-wood termites and of their control as pests of timber or living plants in Queensland.

JARVIS (H.). **Codling Moth Control Experiments, 1930–33.**—*Queensland Agric. J.*, xl, pt. 1, pp. 25–34. Brisbane, 1st July 1933.

In an attempt to discover a material harmless to man and as efficient as lead arsenate in sprays against the codling moth [*Cydia pomonella*, L.] on apple, experiments were carried out in Queensland during the season 1932–33 with barium fluosilicate (1 lb. to 40 gals.), mixtures of nicotine sulphate (1 : 640) or Katakilla (2 lb. to 32 gals.) with white oil (1 : 80), and white oil alone (1 : 64). Four applications of approximately $\frac{3}{4}$ gal. were made in sunny weather between 4th November and 9th January to each of four trees 5–6 years old, control trees being treated with lead arsenate (2 lb. to 40 gals. for the calyx spray, and 1 lb. to 40 gals. for the 3 cover sprays). Infestation by the first brood was not heavy, but it increased later in the season. The white oil alone was reasonably cheap and gave as good control (nearly 98 per cent.) as lead arsenate without injury to fruit or foliage. The combinations of oil with nicotine sulphate or Katakilla were slightly more efficient, but much more expensive ; possibly, however, the strength of these two sprays might be reduced and only three applications made. Barium fluosilicate gave 92·8 per cent. control.

Bands of corrugated paper dipped in a hot solution of beta-naphthol in kerosene (1 lb. : 1 qt.) were placed on apple trees in two plots on

5th and 6th December and removed on 7th February to breeding cages. They were examined on 1st and 2nd May. In the treated bands 78·6 and 94·2 per cent. of the larvae of *C. pomonella* had died, as against only 13·3 per cent. in untreated bands from control trees.

During the season 1930–31, a bait of crude molasses and water (1 : 16) was suspended in pans in apple trees in two orchards. More moths were caught in pans hung from light poles about 14 feet long on a level with the tops of the trees than in those at a lower level, but the former dried up much more rapidly. The traps were usually examined and reset weekly, a pint of fluid being used in each pan. In one orchard, 212 codling moths were caught in 12 traps between 15th October 1930 and 16th February 1931, and in the other orchard, 180 in 8 traps. *C. pomonella* formed only a small fraction of the insects caught, which included *Cirphis unipuncta*, Haw., *Heliothis obsoleta*, F., *Euxoa radians*, Gn., *Prodenia litura*, F., *Agrotis spina*, Gn., *Dysdercus* sp., which was abundant in the orchards in the mid and late season and caused some spotting of apples, and *Heteronyx* spp., which are common foliage feeders [*cf.* xix, 163], besides numerous flies, etc. Little control of *C. pomonella* was obtained in either orchard.

Six applications were made on apple of a proprietary dust containing 15 per cent. lead arsenate, the first coinciding with the calyx spray and the others 13, 28, 37, 75, and 86 days later, and four of a spray of $2\frac{1}{4}$ lb. lead arsenate in 60 gals. water (a calyx spray and three others, 14, 49 and 75 days later). The percentage of fruit infested with *C. pomonella* was only 15·4 on sprayed trees, as against 40·5 on dusted ones and 100 on controls. Dusting may be of value, however, as a supplementary measure at critical times.

KRAUSS (F. G.). **The Pigeon Pea** (*Cajanus indicus*). **Its Improvement, Culture and Utilization in Hawaii.**—*Bull. Hawaii Agric. Expt. Sta., Honolulu*, no. 64, 46 pp., 18 figs., 1 pl., 26 refs. Washington, D.C., March 1932. Price *Cts.* 20. [Recd. September 1933.]

In Hawaii, pigeon peas (*Cajanus indicus*) are attacked by a number of insects that are not widely destructive but are troublesome in some localities. The most serious is *Coccus elongatus*, Sign., which covers the stems and trunks of the plants and during the past two years has caused their death over several hundred acres in Maui and Hawaii, though it is usually controlled by natural enemies. Occasional injury is caused by *Lampides* (*Lycaena*) *baetica*, L., and to the young seedlings by cutworms. In 1927, pigeon peas were infested by the Tineid, *Hieroxestis omoscopa*, Meyr., common in a neighbouring oleander forest.

MILLER (N. C. E.). **Lac in Malaya. Part I. Observations on a Lac Insect** (*Laccifer javanus*, **Chamb.**) **and an Account of Attempts to propagate it.**—*Sci. Ser. Dept. Agric. S.S. & F.M.S.*, no. 11, 24 pp., 3 pls., 3 refs. Kuala Lumpur, 1933. Price *Cts.* 50.

Investigations were undertaken to determine the possibility of the cultivation on a large scale of *Laccifer javanus*, Chamb. [*R.A.E.*, A, xiii, 420], which was found encrusting the trunks of *Macaranga megalophylla* and *Ficus polysyce* in Malaya. The lac produced, however, was of poor quality, and attempts to propagate the insect on *M. populifolia*, *Mallotus cochinchinensis* and *Pithecolobium* (*Enterolobium*) *saman* were unsuccessful. An attempt will be made, however, to

establish on *P. saman* a brood of *L.* (*Tachardia*) *lacca*, Kerr, obtained from India.

L. javanus, all stages of which are described, has three broods annually, the larvae emerging over a period of about 12 days in February, June and November. The males develop in 65–75 days, winged males from lac established in November being found on tree trunks at the end of the following January. The females, one of which was found to contain 300 larvae, cease feeding about 3 weeks before "swarming" occurs. Larval development is accelerated by the early cutting of the branches, possibly owing to the resulting decrease in moisture content. Natural enemies [*cf.* xix, 26, 650], which are the most important factor limiting the spread of *L. javanus*, include the Eulophid, *Tetrastichus purpureus*, Cam., the Encyrtids, *Tachardiaephagus tachardiae*, How., and *Coccophagus tschirchii*, Mahd., *Microbracon* sp., and a Cecidomyiid, the larvae of which feed as ectoparasites and occasionally pupate in empty tests. The presence of the last-named, which is abundant and very destructive, is indicated by the pale crimson colour of the sticky exudations of the lac insects. The stages are described, except the egg, which was not observed, though it is believed to occur among the wax filaments. The Noctuids, *Eublemma roseonivea*, Wlk., and *E. amabilis*, Moore, were observed damaging lac during field observations, but they do not appear to be numerous. *E. roseonivea* constructs an ovate, concave pad of silk for pupation, to which the pupa is attached by silk threads. The larvae of *E. amabilis* [*cf.* xviii, 638] burrow beneath the resinous tests, parts of which are ingested and voided, though they do not appear to contain substances of nutritive value. They feed under a web of silk containing grains of excrement and débris from the bark, and pupate in a cocoon composed of silk and frass within a larger ovate covering. This species is attacked by the larvae of the ectoparasite, *Elasmus claripennis*, Cam. The uneven distribution of the incrustations observed in the field is partly due to the tunnels constructed by *Eutermes* and an ant, which cover the lac, killing the developing insects. Ants are chiefly responsible for the spread of *L. javanus*, though wind may have some influence, particularly under conditions of scattered vegetation. Species such as *Meranoplus mucronatus*, F. Smith, and *Polyrhachis bellicosa*, F. Smith, consume a considerable quantity of the fluid exudations of the lac insects, thus reducing the conditions favourable to the development of a fungus, *Fumago* sp., which kills some of them. Heavy rains may dislodge newly-emerged larvae, and prolonged exposure to the sun causes the resin to melt and block the respiratory orifices in the tests.

GEORGI (C. D. V.) & TEIK (Gunn Lay). **The Valuation of Tuba Root.** —*Sci. Ser. Dept. Agric. S.S. & F.M.S.*, no. 12, 30 pp., 9 refs. Kuala Lumpur, 1933. Price *Cts.* 50.

In view of the variation in the rotenone content of consignments of derris root grown in Malaya [*R.A.E.*, A, xxi, 26], it is suggested that some standard method of valuation should be established, so that buyers could maintain standard grades of root for export. Ultimately, the only satisfactory method would be a biological one, based on toxicity tests. So long as chemical methods are used, rotenone content is probably the best criterion, this being by far the most toxic constituent [xix, 102]. Methods of sampling and preparing the root and determining the content of water and the amount of the solvent extract are

discussed. The only difficulty in the way of standardisation is in the actual process of determining the rotenone content. For this purpose, carbon tetrachloride [xx, 283] or chloroform proved a more satisfactory solvent than ether. Though the endoderm of the root was found to yield more of both rotenone and ether extract than the cortex, the difference was insufficient to warrant separation of the parts before analysis. A rotenone content of 1·5 per cent. was found in a sample of *Derris malaccensis* as against 4·6 in *D. elliptica* [*cf.* xxi, 26].

PAGDEN (H. T.). **Notes on Padi Stem Borers.**—*Malayan Agric. J.*, xx, no. 3. pp. 122–130, 5 graphs, 7 refs.

CORBETT (G. H.). **Results on Stem Borer Experiments in Krian during the 1931–32 Padi Season.**—*Op. cit.*, xxi, no. 8, pp. 362–378, 2 diagr. Kuala Lumpur, 1932–33.

Both papers include data collected by Pagden on the seasonal incidence of *Diatraea auricilia*, Dudg., and *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) on rice in Malaya and the results obtained by colonisation of *Trichogramma minutum*, Riley (erroneously recorded in one report as *Trichogrammatoidea* (*Trichogramma*) *nana*, Zhnt. [*R.A.E.*, A, xxi, 260]). The first paper, in addition to some information previously noticed [xx, 12], contains a list of the alternative food-plants of *D. auricilia* and *Sesamia inferens*, Wlk., including some new records [*cf.* xviii, 656]. Attack by these two borers is marked by complete or partial whitening of the panicles, caused by the larvae entering the flowers while they are still enclosed by the sheath ; it may generally be distinguished from other forms of injury by the presence of small, round holes in the glumes. Larvae of *Schoenobius bipunctifer* were observed to migrate in flooded fields by floating in rolled portions of leaves. The eggs of this moth are attacked by *Eupteromalus* sp. and *Tetrastichus schoenobii*, Ferrière [xix, 538], which appears to be very important late in the season, the older larvae destroying not only the eggs but also the larvae remaining under the egg-masses.

In the season 1930–31, as estimated by collections of egg-masses and of adults in light-traps, *S. bipunctifer* was scarce till January–February, when the peak of oviposition was reached, decreasing again in April ; in 1931–32, however, the egg-masses were most numerous in November–December, and the number of adults increased in December and decreased in March. Oviposition by *D. auricilia* during the former season was greatest in February, from which month onwards the adults were numerous until mid-May ; in the following one, the egg-masses were abundant in December and the adults from December until March, when the experiments ended. These variations are probably due to the earlier planting of the rice crop in 1931–32, though it is considered that *D. auricilia* is to some extent seasonal in the Krian District, as evidenced by the good crop obtained by early planting even when the area is adjacent to one planted later and subsequently subject to heavy infestation.

In 1931–32, natural parasitism of *S. bipunctifer* by *T. minutum* and *Phanurus beneficiens*, Zhnt., in the two areas observed was highest in January, reaching 50 and 70 per cent., and that of *D. auricilia* by *T. minutum* only was greatest in January and March respectively, reaching 46·4 and 41·2 per cent.

Experimental colonisations of *T. minutum* were made in a number of small plots in an area of rice. In 1930–31, the parasites were liberated

daily at a rate equivalent to a total of 1,300,000 per acre from the beginning of the rice season until the ripening of the grain, and this was followed by a marked increase in parasitised eggs. This is too high a rate for work on a large scale, and in 1931–32, an attempt was made to put the liberation of the parasites on a more economic basis by releasing them at the rate of 200,000 individuals per acre during a short period at the first sign of increased borer activity. The results indicated that, under the conditions of the experiment, this method of liberation is ineffective. In any case it is only the eggs of *Diatraea* that are attacked to any extent by *Trichogramma*; egg-masses of *Schoenobius* are largely protected by their hairy covering, and of 68 egg-masses of *Chilo* sp. collected, *T. minutum* emerged from one and *P. beneficiens* from 33.

Liu (Chi-ying). **The Effect of Winter Cultivation on the Quantitative Abundance of the two Kinds of Borers in the Rice Stubbles** (*Schoenobius incertellus* **Walk. and** *Chilo simplex* **Butl.**). [*In Chinese.*]—*Ent. & Phytopath.*, i, no. 18, pp. 390–392. Hangchow, 21st June 1933. (With a Summary in English.)

The numbers of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) per thousand rice stubble clusters were found to be 22·63 in fields growing a green manure crop, 27·7 in fields left fallow and 0·56 in wheat fields, and those of *Chilo simplex*, Butl., 64·83, 61·35 and 5 respectively. In all these fields, the previous crop had been a late variety of rice. The scarcity of the two rice borers in the stubble in wheat fields is due to winter cultivation, which is not practised in green manure or fallow fields.

Liu (Chi-ying) & Ma (Tung-lun). **Spring Submergence of Rice Stubbles as a Control Measure of the Rice-borers.** [*In Chinese.*]—*Ent. & Phytopath.*, i, no. 21, pp. 443–451. Hangchow, 21st July 1933. (With a Summary in English.)

A larva of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) hibernating in rice stubble [*cf. R.A.E.*, A, xviii, 35], spins a defensive layer of silk above its body as well as a cocoon. Consequently, when the stubble is submerged in spring, the larvae are unable to escape to the surface and are drowned. If submersion is begun in March, 96 per cent. will be killed in 30 days. Some of the larvae of *Chilo simplex*, Butl., and *Sesamia* (*Nonagria*) *inferens*, Wlk., hibernate in and among rice stubble, but as they are active and do not spin a defensive layer, they can escape to the surface of the water and are not destroyed by submersion [*cf.* xviii, 593].

Hutson (J. C.). **The Coconut Caterpillar.**—*Trop. Agriculturist*, lxxxi, no. 1, pp. 67–69, 1 pl. Peradeniya, July 1933.

An account is given of the bionomics of the Tineid, *Nephantis serinopa*, Meyr. [*R.A.E.*, A, x, 539; xi, 311], the attacks of which on coconut in Ceylon have been less severe during the last 2–3 years, owing to the increased activity of parasites [*cf.* xix, 138] in certain areas and to the general application of the scheduled control measures, which consist of cutting off and burning infested leaves.

Jepson (F. P.). **Report on the Work of the Division of Plant Pest Control.**—*Adm. Rep. Dir. Agric. Ceylon 1932*, pp. D 107–115. Colombo, 1933.

Regulations in force in Ceylon in 1932 against various insect pests of tea and coconut are summarised [*cf. R.A.E.*, A, xiii, 72; xvi, 447]. By a regulation of 1932, the collection and destruction of larvae and cocoons of Limacodids infesting tea [*cf.* xx, 497] was made compulsory. The regulations against *Oryctes rhinoceros*, L., which was the most prevalent pest on coconut in all districts from which it was reported in 1932, aim chiefly at the elimination of its breeding-places [*cf.* xxi, 362, etc.]; it was found to breed extensively in town refuse or other organic matter, including fallen leaves, even when they were buried as deep as possible [*cf.* xix, 741]. This Dynastid also injured palmyra palms (*Borassus flabellifer*). Owing to neglect in the past, serious losses were caused to coconut palms by *Rhynchophorus ferrugineus*, F. (red weevil), particularly on two estates, where 93 palms were killed in 6 months.

Cherian (M. C.). **An Agromyzid Fly predaceous on Aphids.**—*Madras Agric. J.*, xi, no. 8, pp. 343–344, 1 pl. Coimbatore, August 1933.

The larvae of an Agromyzid, *Leucopis* sp., all stages of which are briefly described, have been observed feeding on Aphids on *Sorghum*, cotton, *Pennisetum typhoideum* and *Dolichos lablab* in Madras. The eggs are laid singly on infested plants and hatch in 2–4 days. The larval stage (including 3 instars) lasts 4–5 days, and the pupal 5–7. Adults lived 21 days in captivity.

Isaac (P. V.). **Report of the Imperial Entomologist.**—*Sci. Rep. Imp. Inst. Agric. Res. Pusa 1931–32*, pp. 141–145. Delhi, 1933.

Insects attacking sugar-cane during 1931–32, other than those mentioned in the previous year's report [*R.A.E.*, A, xx, 306], were *Diatraea auricilia*, Dudg., and *Aleurolobus barodensis*, Mask., which was very abundant on cane planted in October 1931. Other pests included: *Prodenia litura*, F., causing considerable damage to castor [*Ricinus communis*]; *Diacrisia* (*Spilosoma*) *obliqua*, Wlk., on *Sesamum indicum*, *Ipomoea batatas*, *Phaseolus radiatus* and *P. aconitifolius*; *Urentius echinus*, Dist., and *Phenacoccus insolitus*, Green, on brinjal [*Solanum melongena*]; *Agrotis ypsilon*, Hfn., and *A. flammatra*, Schiff., attacking potato tubers; *Plutella maculipennis*, Curt., on cauliflowers; *Dialeurodes pallida*, Lamba, on betel [*Piper betle*]; the Sphingid, *Rhyncholaba acteus*, Cram., on grape vines; and the Lycaenid, *Catochrysops* (*Euchrysops*) *pandava*, Horsf., on *Cycas revoluta*. Large numbers of the Meloid, *Mylabris* (*Zonabris*) *phalerata*, Pall., injured ornamental *Hibiscus* during early September, and *Pseudococcus corymbatus*, Green, was abnormally abundant on *H. sabdariffa*, causing the plants to become discoloured and the apices hard and compact, resulting in retarded growth, but was controlled by spraying with resin compound. *Pyroderces simplex*, Wlsm., occurred in large numbers on the ears of *Pennisetum typhoideum*, particularly those affected by fungi, together with the Pyralid, *Stenachroia elongella*, Hmps. *Trionymus sacchari*, Ckll., was a serious pest of rice in one district, in which it has been known for the last three years and is now widespread, preventing the formation of the grain and causing infested plants to turn yellow. Larvae of a Pyralid, *Orthaga* sp., ate the leaves of late-ripening varieties of mango, and the

weevil, *Eugnamptus marginatus*, Pasc., attacked the trees when they were developing fresh leaves at the end of July. Samples of tobacco seedlings from the United Provinces were found to be damaged by *Phthorimaea heliopa*, Lw.

[REKACH (V. N.).] **Рекач (В. Н.). Cutworms as Pests of Cotton and other Crops in Transcaucasia.** [*In Russian.*]—*Trud. Zakavk. nauch.-issled. khlopk. Inst.* (*Trans. Transcauc. Cotton Sci. Res. Inst.*], no. 40, 44 pp., 22 figs., 26 refs. Tiflis, 1933. Price 1 *rub.* (With a Summary in English.)

Notes, partly based on the literature, are given on the bionomics of cutworms that cause considerable injury to cotton in Transcaucasia, the principal species recorded since 1927 being, in order of importance, *Euxoa segetum*, Schiff., *E. temera*, Hb., f. *hübneri*, Bours., *Agrotis* (*Rhyacia*) *ypsilon*, Hfn., and *A.* (*R.*) *c-nigrum*, L. *Feltia exclamationis*, L., *E. conspicua*, Hb., and *A. flammatra*, Schiff., were also observed, but only caused slight damage. The relative importance of the species varies according to the year and the district and depends on weather conditions, but *E. segetum* is the most widespread and injurious. It has three overlapping generations a year, only the larvae of the first causing appreciable damage. Hibernation occurs in the larval or pupal stage ; if the weather is warm, the larvae may become active at the end of February, feeding on various weeds until about the first week in May, when they pupate. The adults emerge in numbers from the beginning of May, and the peak of the flight is reached in the second half of the month. The eggs are laid chiefly on weeds or on the soil near food-plants. In the insectary, adults lived for as long as two weeks ; the maximum number of eggs laid by a female was 722. The life-cycle of the first generation is completed in an average of 56 days, the pre-oviposition and incubation periods each lasting 3–6 days, and the larval and pupal stages 26–36 and 13–22 days respectively. Most of the damage is caused between 5th and 20th June, the larvae preferring *Sesamum indicum*, which is less advanced in development than cotton or *Hibiscus cannabinus*. In 1929 they destroyed 66·8 per cent. of the *Sesamum* plants, 35–50 per cent. of *Hibiscus* and 50 per cent. of cotton in some localities. Considerable control is exercised by parasites, the chief species found in western Azerbaijan being *Apanteles congestus*, Nees, *Amicroplus collaris*, Spin., *Barylypa humeralis*, Brauns, and two unidentified Tachinids.

In Azerbaijan, the larvae of *E. temera*, which has only one generation a year, chiefly attack the germinating seeds and sprouts of cotton and *H. cannabinus*. *Sesamum* is much less injured, as it is sown in the second half of May, when most of the larvae enter a diapause that is terminated by pupation, though some may remain active until about 10th June. The diapause and pupal period together last 89–121 days, the adults occurring in September and the first half of October. Oviposition begins 4–5 days after emergence ; in the insectary, the eggs were laid on the soil, and since none hatched, it may be presumed that they hibernate. The duration of the larval stage has not been ascertained, but it probably lasts at least six weeks, injury being observed from mid-April onwards.

A. ypsilon probably has three annual generations, the adults occurring in May and July and again in autumn, sometimes as late as the end of October. In summer, the egg stage lasts $3\frac{1}{2}$–$4\frac{1}{2}$ days, the larval 4–5 weeks and the pupal about 2 weeks. Only the first-brood larvae

are of economic importance, causing injury to cotton from mid-May till the end of June. Further infestations do not occur, probably owing to the high mean temperature, which in July and August reaches 30–39°C. [86–102·2°F.] in the shade, that of the soil at a depth of 4 ins. being 33–45°C. [91·4–113°F.], whereas the optimum for the development of the larvae lies between 24 and 28°C. [75·2–82·4°F.] [*R.A.E.*, A, xx, 475].

A. c-nigrum has three generations a year in Azerbaijan, the full-grown larvae of the third hibernating. The adults are on the wing in the first half of May, in the second half of July, and in early September. Lucerne is the chief crop attacked, cotton being slightly infested. In the summer, the life-cycle is completed in about 7 weeks, of which 12–14 days are spent as pupae.

Control measures recommended include destruction of weeds attractive to ovipositing females; winter ploughing to destroy the hibernating larvae or pupae; flooding to accelerate the development of the young plants and drown the larvae or make them rise to the surface of the water where they are destroyed by birds, etc.; and, in the case of *E. segetum*, early sowing of cotton. As a result of experiments with bran baits, one containing 5 per cent. sodium arsenite scattered at the rate of about 58 lb. to the acre is particularly recommended. The introduction of baits into the soil simultaneously with the cotton seeds was found impracticable, as it reduced their germinating power to 9 per cent. as compared with 75 per cent. in the controls. As the adults of the three most injurious species, *E. segetum E. temera* and *A. ypsilon*, are attracted to fermenting grape juice diluted with water, bait traps could be used as a supplementary measure from the end of April to the beginning of June.

[BEĬ-BIENKO (G.).] **Бей-Биенко (Г.). The Importance and Outlook of Aviation in the Control of injurious Grasshoppers.** [*In Russian.*] —*Plant Prot.*, 1932, no. 1, pp. 43–50, 3 refs. Leningrad, 1932. (With a Summary in English.) [Recd. September 1933.]

The use of aeroplanes for scattering poisoned dust and baits against locusts is strongly recommended; owing to its rapidity, this method permits the destruction of the main masses of hoppers while they are in their first three instars. It has been found in Transcaucasia that hoppers of *Dociostaurus maroccanus*, Thnb., do not feed for several hours before and after each moult, and hence the application of stomach poisons usually produces only 80–85 per cent. mortality. Dusting from aeroplanes with sodium arsenite, which acts both as a stomach and a contact insecticide, at the rate of 2 kg. per hectare [1·8 lb. per acre], produces 100 per cent. mortality. Investigations have also been made on baits, however, as the dust cannot be used in cultivated areas, owing to the danger of injury to plants. They showed that good results may be obtained by scattering dry or slightly moist baits from aeroplanes, at the rate of 15 kg. (containing 6·7–10 per cent. of sodium arsenite) per hectare [13·35 lb. per acre].

[MEDYAKOVA (O. I.).] **Медякова (О. И.). On the Economic Effect of** *Harmolita eremitum* **Portsch.** [*In Russian.*]—*Plant Prot.*, 1932, no. 1, pp. 56–68, 3 figs., 8 refs. Leningrad, 1932. (With a Summary in English.) [Recd. September 1933.]

In view of the disagreement in the literature as to the economic importance of *Harmolita eremita*, Porch., on rye [*R.A.E.*, A, xvii, 592,

etc.], laboratory investigations were carried out with plants collected in the neighbourhood of Samara [*cf.* xix, 596]. The method used consisted in measuring the length and thickness of infested and uninfested stems and the length of the ears, and comparing the number and weight of grains [*cf.* xix, 594]. As the plants obtained for the investigations tillered little, almost all the stems examined were primary ones. The results, which are described in detail, showed that this Eurytomid had no detrimental effect on the plants, its apparent injuriousness being entirely due to its attacking stems that are already thin and poorly developed.

[Vodinskaya (K. I.).] **Водинская (К. И.). Some data on *Eurytoma amygdali* End.** [*In Russian.*]—*Plant Prot.*, 1932, no. 1, pp. 97–106, 6 figs., 1 graph, 20 refs. Leningrad, 1932. (With a Summary in English.) [Recd. September 1933.]

An account is given of field observations on *Eurytoma amygdali*, End., carried out in the summer of 1930 in the Tuapse district of Transcaucasia, where it is an important pest of plums. The eggs, larvae and adults are described, and the life-history is briefly outlined [*cf. R.A.E.*, A, ii, 348 ; xix, 595]. In 1930 the adults emerged about 5th May and oviposited first in fruits of *Prunus cerasifera* (*myrobalana*), the flowering of which was by this time over, and 10 days later in cultivated plums, oviposition lasting over a period of 2–4 weeks. The eggs are laid inside the stone, which is then still soft. Infested fruits change colour sooner than normal ones, and begin to drop at different dates depending on the variety of the tree ; in 1930, the dropping began in June from *P. cerasifera*, and was very severe from plums in July. The intensity of the infestation varied from 77 to 12 per cent. according to the variety of plum. Trees growing in shady places were less attacked and their fruit dropped later.

To a much less extent, the plums were also infested by the weevil, *Rhynchites bacchus*, L., associated with the fungus, *Monilia* sp. [xvii, 429], and by *Cydia* (*Laspeyresia*) *funebrana*, Treit. The fruits attacked by these insects drop very soon, and if they also contain larvae of the Eurytomid, the latter die.

The only effective method of controlling *E. amygdali* is to bury the fallen fruits at a depth of at least 18 inches. In an orchard where this was done in 1929, the infestation in 1930 only averaged 19·1 per cent., as compared with 41·4 per cent. in an adjoining one. It is suggested that experiments should be made with a view to finding a repellent spray that would prevent the adults from ovipositing.

[Nikol'skaya (M. N.).] **Никольская (М. Н.) The Clover Seed Chalcid (*Bruchophagus gibbus* Boh.) in Alfalfa Seeds in USSR.** [*In Russian.*]—*Plant Prot.*, 1932, no. 1, pp. 107–111, 3 figs., 15 refs. Leningrad, 1932. (With a Summary in English.) [Recd. September 1933.]

Infestation of lucerne by *Bruchophagus gibbus*, Boh., was recorded, for the first time from the Russian Union, in Poltava in 1929 [*R.A.E.*, A, xix, 369], the percentage of the seeds attacked having varied from 1·3 to 25 in 1927–28. Brief descriptions of the adults of both sexes are given, and the history of this Eurytomid in Europe and the United States, into which it was probably introduced with lucerne, and where

it has been recorded as *B. funebris*, How., is briefly reviewed. A. V. Gahan has found that *B. funebris* is a synonym.

The following parasites, here given in order of frequency, were bred in Poltava from *B. gibbus* in lucerne seeds: *Habrocytus medicaginis*, Gah., *Tetrastichus bruchophagi*, Ashm., *Liodontomerus perplexus*, Gah., *Eupelmus microzonus*, Först., *E. atropurpureus*, Dalm., *E. vesicularis*, Retz., *Tetrastichus tibialis*, Kurd., *T. brevicornis*, Nees, *T. roesellae*, Nees, and *Eutelus* sp. Of these, the first three have been recorded from the United States as from *B. funebris* [vii, 265; viii, 361]. On the whole, the rate of parasitism in Poltava ranged from 23·8 to 80·9 per cent., which is much higher than has ever been recorded in the literature. *H. medicaginis* and *T. bruchophagi* were together responsible for over 90 per cent. of the parasitism.

[Bogdanov-Kat'kov (N. N.).] **Богданов-Катьков (Н. Н.). Anabasine and its Application.** [*In Russian.*]—Demy 8vo, 12 pp., 12 refs. Moscow, Vses. gos. Ob'ed. Bor'be Vred. Bol. sel. lesn. Khoz. [All-Un. St. Ass. Contr. Pests Dis. Agric. For.], 1933.

This pamphlet gives information in a popular form on the properties, cost, preparation and application of anabasine [*R.A.E.*, A, xx, 37; xxi, 535], an insecticidal alkaloid discovered in 1929 in *Anabasis* [*aphylla*], a perennial chenopodiaceous shrub abundant in the Lower Volga Region, southern Ural and especially Kazakstan. In chemical composition, anabasine ($C_{10}H_{14}N_2$) is analogous to nicotine. The amount contained in the plant depends on its stage of development; a sharp decline occurs during the flowering period and as the seeds mature, the maximum being found during the vegetative periods before and after flowering. The raw material is, therefore, collected from 1st June till mid-October, but not during the time of the flowering. The maximum quantity of the alkaloid (2·53 per cent.) is found in the small green twigs; the thick green branches contain 0·37 per cent., and the old woody ones only 0·17 per cent. The best method of collection is to remove small twigs at the level of the branching of the main stem; in this way it is possible to obtain a second crop of twigs 50–60 days after the first harvest.

The method of extracting the anabasine and preparing from it a 36–40 per cent. anabasine sulphate solution is briefly described. As an insecticide, this solution may be used as a spray at a concentration of 0·03 per cent. with the addition of 0·4 per cent. soft soap or naphthene soap [xx, 202], or 0·5 per cent. "Contact" [xx, 200]. For orchard spraying, etc., the soap or "Contact" may be omitted and the sulphate combined at the same rate with water containing 0·08 per cent. fine freshly slaked lime or with lime-sulphur (1 : 60); it is not effective if used alone. It may also be employed as a dust with a carrier such as lime or with calcium arsenate, at rates of from 5 : 95 to 15 : 85. The dust is prepared by spraying the solution uniformly over the carrier and mixing thoroughly in a rotating drum. A table shows the dosages of anabasine sulphate that should be added to the water or carrier to obtain different concentrations of spray or dust. If the sulphate contains less than 36–40 per cent. of the alkaloid, the quantities are increased accordingly.

The present high cost of anabasine preparations makes their extensive use prohibitive, and further work should be carried out to determine the minimum effective dosages. Tables are given showing the

amount of spray or dust necessary to treat a given area of orchard, vineyard or cultivated field at a temperature of 15–20°C. [59–68°F.]. The toxicity of anabasine increases at higher temperatures, and this permits of a decrease in dosage.

JACOBS (S. N. A.). *Aphomia gularis* (**Zell.**) **and other rare Warehouse Moths.**—*Entomologist*, lxvi, no. 844, p. 195. London, September 1933.

The Pyralid, *Aphomia gularis*, Zell., is recorded from warehouses in London in which Spanish almonds were stored [*cf. R.A.E.*, A, xix, 404]. On 2nd August a captured female laid batches of eggs on almonds, and the larvae hatched on 7th August.

Several adults of two Pyralids that attack dried dates were taken in other warehouses. Of these, *Myelois phoenicis*, Drnt., is an Algerian species, and *M. ceratoniae*, Zell., is also known to infest both Algerian and Cyprus locust-beans [*Ceratonia siliqua*] and quinces from South Africa as well as from Mediterranean countries.

DE FLUITER (H. J.) & BLIJDORP (P. A.). **Voorloopige mededeeling omtrent de beschadiging door de larve (1ste stadium) van den grauwen dennensnuitkever** *Brachyderes incanus* **L. aangericht aan de wortels van de grove den.** [Preliminary Communication on the Injury to the Roots of *Pinus sylvestris* by the first-instar Larva of the grey Pine Weevil, *B. incanus*.]—*Tijdschr. PlZiekt.*, xxxix, no. 8, pp. 212–213, 1 pl. Wageningen, August 1933.

In experiments in Holland, newly hatched larvae of *Brachyderes incanus*, L., placed on the roots of 6-year-old pines (*Pinus sylvestris*) in pots, were observed to bore into the roots, preferably where a large and small one joined. Several larvae had buried themselves almost entirely after a week, and such infestations killed roots up to $\frac{1}{8}$ inch thick.

VON TUBEUF (C. Frhr.) & HABESREITER (—). **I. Nachtrag zu Studien über Symbiose und Disposition für Parasitenbefall sowie über Vererbung pathologischer Eigenschaften unserer Holzpflanzen. II. Dispositionsfragen für den Befall der Bäume durch Pilze und Käfer.** [First Supplement to Studies on Symbiosis and Susceptibility to Attack by Pests and Diseases, as well as on Inheritance of Pathological Characters, in German Ligneous Plants. ii. Questions of Susceptibility relating to the Infestation of Trees by Fungi and Beetles.]—*Z. PflKrankh.*, xliii, no. 8–9, pp. 472–476, 5 figs. Stuttgart, 1933.

In this supplement [*cf. R.A.E.*, A, xxi, 434], details are given of an infestation of a perfectly healthy spruce on which 20 adults of *Dendroctonus micans*, Kug., were caged in 1931. Two years later, there was evidence that the beetle had maintained itself, but the infestation was exceedingly slight and the tree did not appear to be harmed.

KÖRTING (A.). **Untersuchungen über die insektizide Wirkung einiger Fluorverbindungen.** [Investigations on the Insecticidal Action of some Fluorine Compounds.]—*Z. PflKrankh.*, xliii, no. 8–9, pp. 502–516, 16 refs. Stuttgart, 1933.

The literature on the use of fluorine compounds as insecticides is reviewed. In the experiments here described, in which bees were the

test insects, the order of rapidity of action was : potassium fluosilicate, sodium fluoride, potassium fluoride, sodium fluosilicate, barium fluosilicate, calcium fluoride, synthetic cryolite (sodium aluminium fluoride). Potassium fluosilicate, sodium fluoride, potassium fluoride, barium fluosilicate and cryolite produced a mortality of 100 per cent. in nearly all tests. Sodium fluosilicate was much less toxic, and calcium fluoride gave 100 per cent. mortality once only. Further experiments were made with batches of 100 bees to ascertain the minimum lethal dose, the mortality being compared with the amount of poison ingested. Potassium fluoride was not tested, because its high solubility made exact dosage difficult. Of the other compounds, potassium fluosilicate was the most poisonous, an average dose of 6·9 mmg. per bee producing a mortality of 18 per cent., while from 8·2 to 10·3 mmg. were needed of sodium fluoride, cryolite or barium fluosilicate to kill 19–21 per cent. Sodium fluosilicate was less effective (30·1 mmg., 19 per cent.), and calcium fluoride was the weakest (56·4 mmg., 17 per cent.).

SPEYER (W.). **Die an der Niederelbe in Obstbaum-Fanggürteln überwinternden Insekten. II. Mitteilung. Coleoptera : Bruchidae, Anthribidae, Curculionidae.** [Insects hibernating in Fruit-tree Trap-bands in the Lower Elbe Districts. Second Communication.] —*Z. PflKrankh.*, xliii, no. 8–9, pp. 517–533, 2 pp. refs. Stuttgart, 1933.

This second communication [*cf. R.A.E.*, A, xxi, 203] comprises an annotated list of Bruchids, Anthribids and Curculionids found in bands on fruit-trees and willows in the Lower Elbe districts from 1926 to 1932. With the exception of *Anthonomus pomorum*, L., they are not orchard pests, and were usually found only occasionally in the bands. *A. pomorum* preferred pear to apple and cherry, and was rare on plum [*cf.* xix, 158], so that a preference for rough bark may be one factor in selection of winter quarters, though willows with rough bark were seldom chosen. The adults seek winter quarters in July, but do not all remain settled ; up to October, many change their shelters. They were most numerous in bands of corrugated cardboard, straw rope coming next. Many of the overwintering weevils were killed by a fungus or parasitised by a Braconid, (?) *Perilitus* sp. The parasites emerge in early June and oviposit in the adult weevils. The larva overwinters in the host, coming out to pupate soon after the latter has emerged from hibernation. Parasitised weevils die without reproducing.

FUCHS (W. H.). **Beobachtungen an** *Tropinota hirta*. [Observations on *Epicometis hirta*.]—*Z. PflKrankh.*, xliii, no. 8–9, pp. 563–565, 2 figs., 1 ref. Stuttgart, 1933.

Laboratory observations are described in which adults of the Cetoniid, *Epicometis* (*Tropinota*) *hirta*, Poda, taken from cherry blossoms in Saxony were given fresh blossoms of cherry and rape, to which latter they have been recorded as injurious. The beetles appeared to feed on the secretions of the receptacles, perhaps also on the extine of the pollen, without causing any perceptible injury.

Abdel Aziz Ali Elsayed Ghabn. **Zur Biologie und Bekämpfung eines neuen Nelkenschädlings aus der Gruppe der Thysanopteren in Aegypten.** [On the Biology and Control of a new Thysanopterous Pest of Carnations in Egypt.]—*Dissert. Landw. Hochschule*, Berlin, 1932, 72 pp. (Abstract in *Z. PflKrankh.*, xliii, no. 8–9, p. 575. Stuttgart, 1933.)

Temperature was the chief factor affecting *Haplothrips cottei*, Vuillet, on carnations (*Dianthus caryophyllus*) in Egypt. At 30°C. [86°F.], the mortality was 90 per cent. ; below 18°C. [64·4°F.], it was 100 per cent. Parthenogenesis was not observed, but females were twice as numerous as males. Carnation was the only plant attacked. Spraying did not prove effective, but a mortality of up to 75 per cent. was obtained by fumigation in winter with hydrocyanic acid gas.

Cowland (J. W.). **Gezira Entomological Section, G.A.R.S. Final Report on Experimental Work, 1931–32.**—*Ann. Rep. Gezira Agric. Res. Serv. Sudan Govt. 1932*, pp. 93–112. [Wad Medani, 1933.]

An account is given of work on pests of cotton in the Sudan in the year ending 30th April 1932, much of the information on *Bemisia gossypiperda*, Misra & Lamba, the vector of leaf-curl, having been previously noticed [*R.A.E.*, A, xx, 623]. The exclusion of lubia (*Dolichos lablab*) from the rotation of crops [xx, 624] seems to have given good results, though an unexpected amount of crinkled ratoon survived the dead season and appeared in the fallow fields at the beginning of the rains. Experiments and observations have shown that ratoon cotton, which is probably the chief source of infection, is not readily attacked by the whiteflies unless in close proximity to an attractive plant such as lubia. The number feeding on the ratoon in fallow and migrating from it to young cotton is therefore small. Together with a decrease in the incidence and severity of the disease, there was a reduction in the number of whiteflies, compared with those present in previous years, partly owing to the complete destruction of *Ipomoea cordofana* over large areas by larvae of the convolvulus hawk-moth [*Herse convolvuli*, L.] when the immature stages of *B. gossypiperda* were developing on the leaves. Apart from a few garden shrubs such as *Lantana* spp. or Cape gooseberry [*Physalis peruviana*], the whiteflies have been found in the Gezira only on herbs, usually on annuals except for *Withania somnifera*. Experiments proved that they are able to transmit leaf-curl to seedlings after feeding on diseased ratoon plants of Sakel cotton [*Gossypium peruvianum* × *barbadense*] of different ages (2½–4½ months), but do not contract infection from plants that have recovered or from those infected but not showing symptoms. Some whiteflies remained infective after an interval of 4 days on lubia or 8 days on healthy Sakel. During April–June, the feeding of whiteflies from Sakel resulted in the production of symptoms of mosaic in 4 out of 6 plants of Watts Long Staple (American) cotton [*G. hirsutum*] in 12–20 days, but during December–February, 2 out of 14 developed slight crinkle vein-enations on 1–2 leaves after 11 days. Later leaves showed no symptoms, and the subsequent generation of whiteflies failed to re-infect plants of either variety. Experiments to determine whether infection could be obtained in Watts Long Staple by passage of the virus from *Hibiscus esculentus* through *H. cannabinus*, and in one case also through Sakel, gave negative results [*cf.* xix, 709]. The development of the disease was relatively late and slight in cotton plants sown in October or later.

The larvae of *Heliothis obsoleta*, F., caused considerable damage sporadically to the earliest flower-buds of cotton throughout October, and towards the end of the year large numbers were found on the flowers and pods of lubia. The normal increase in the numbers of *Platyedra gossypiella*, Saund., was checked by cold weather in February. *Earias insulana*, Boisd., attacked 2–4 per cent. of the crop. In view of the importance of *Abutilon* spp. in the life-history of parasites of the bollworms [xx, 622], observations were undertaken on the species emerging from the fruits and their seasonal distribution. *Microbracon kirkpatricki*, Wlkn., emerged from the larvae of *Crocidosema plebeiana*, Zell., fairly frequently up to the end of 1931 and then gradually disappeared. *M. brevicornis*, Wesm., attacked *E. insulana* during December–January and later was found parasitising *Sesamia cretica*, Led., in stools of *Sorghum*. *Apanteles earterus*, Wlkn. [xix, 26] and *Elasmus johnstoni*, Ferrière [xviii, 55] emerged from *E. insulana* occasionally throughout the winter.

Hercothrips fumipennis, Bagn. & Cam., and *H. sudanensis*, Bagn. & Cam. [xx, 621 ; xxi, 544] continue to breed throughout the summer in small numbers on lucerne (*Medicago sativa*) and on weeds in sheltered situations, gardens, etc. ; they become scarce during the period of heaviest rainfall, which is usually in July and early August. It is probable that the pupae or adults have some means of resting over periods of inclement weather. In one experiment, some adults emerged normally from the soil about 6 days after pupation, whereas 2 females emerged after 5½ months. Some varieties of cotton appeared to be immune from attack by these thrips. Two species of *Frankliniella* [recorded as undetermined thrips in a previous paper (xx, 621)], of which *F. dampfi*, Priesn., is usually more important than *F. intercellaris*, Karny, are exceedingly abundant on weeds and on cotton and other crops in the Gezira. They are particularly important during September–November, causing malformation and curling of the young leaves and severely retarding the growth of late-sown cotton. The Halticid, *Podagrica puncticollis*, Wse., infested cotton sown in July or adjacent to *Abutilon* spp., from which it had migrated. Larvae of the Rutelid, *Adoretus rugulosus*, Burm., which usually attack *Sorghum*, caused wilting of cotton plants by feeding on the roots.

Monthly examination of stools of *Sorghum*, to determine to what extent *Sesamia cretica* maintains itself in them, showed that before the stools had dried up, the young larvae were numerous among the roots and the older larvae and pupae in the small shoots. In April, some dried shoots contained resting larvae, and young larvae were much less abundant in the stools.

MOORE (E. S.). **The Kromnek or Kat River Disease of Tobacco and Tomato in the East Province (South Africa).**—*Sci. Bull. Dept. Agric. S. Afr.*, no. 123, 28 pp., 1 diagr., 8 pls., 12 refs. Pretoria, 1933. Price 3*d*.

An account is given of investigations carried out intermittently since 1929 in eastern Cape Province on a virus disease causing stunted growth and malformation and discoloration of the leaves of tobacco and tomato. Observations and experiments indicated that no relation exists between its occurrence in tobacco and infestation by *Phthorimaea operculella*, Zell., Aphids or flea-beetles. In experiments with a species of *Frankliniella*, similar to *F. insularis*, Frankl., the vector of spotted

wilt disease of tomato in Australia [*R.A.E.*, A, xviii, 665], the feeding of adults from the field produced systemic infection in 14 out of 16 healthy tobacco plants in 14 days and that of larvae reared on diseased tomato leaves caused the appearance of typical symptoms in 5 out of 10 healthy tomato plants in 21 days. The disease was also observed to occur in a number of other solanaceous plants in the field, and several of these were experimentally infected by means of the thrips. Tests in which non-infective larvae and adults from carnation flowers were fed on diseased tomato leaves and, after an interval for incubation, were placed in healthy tomato plants, showed that only the larvae are capable of contracting infection. A study of this thrips and its biology and distribution in relation to the disease suggests that it is the principal, if not the only, means by which the latter is transmitted.

When thrips from carnation flowers were reared on tomato leaves, an interval of 12–18 days occurred from the caging of adults of one generation to the first appearance of those of the next under mid-summer conditions. The thrips feeds and reproduces readily on the leaves of tomato, particularly on the young seedlings. It is more difficult to find in tobacco, however, and does not seem to breed there, except possibly in the flowers, which do not appear until January. Infective individuals are found in the seed-beds, in the summer flowers of diseased plants and also in the flowers produced in the spring by the sucker-shoots of old tobacco stumps overwintered in the field, on which they may possibly hibernate. The disease is often more severe after a field has lain fallow instead of being planted with winter wheat, and it is possible that the thrips migrate to weeds, particularly the flowers of wild composite plants, which form favourable breeding centres and occur freely in the spring in the veldt and along the edges of cultivated lands. Adults have been found in the flowers of *Citrus*, *Venidium decurrens*, rose, *Petunia*, *Gaillardia* and carnation, and in great numbers in ripening wheat fields in November.

CHIAROMONTE (A.). **Considerazioni entomologiche sulla coltura delle piante da frutto nella Somalia Italiana.** [Entomological Notes on Fruit-tree Growing in Italian Somaliland.]—*Agric. colon.*, xxvii, no. 8, pp. 383–385. Florence, August 1933.

The author observed no serious pests of fruit-trees in Italian Somaliland. *Ferrisiana* (*Ferrisia*) *virgata*, Ckll., and *Aspidiotus destructor*, Sign., were occasionally found on banana. *F. virgata* was more numous on the leaves of guava (*Psidium*) and *Anona*, and the fruits of these trees were slightly mined by the larvae of *Argyroploce leucotreta*, Meyr. Insects found on *Citrus* were *Aphis tavaresi*, Del. G., *Coccus hesperidum*, L., *Lepidosaphes beckii*, Newm., and *Papilio demodocus*, Esp. Most of these pests were largely controlled by predacious Coccinellids and Hymenopterous parasites. *Cydonia vicina*, Muls., *C. lunata*, F., *C. propinqua* var. *nigrescens*, Wse., *Scymnus morelleti*, Muls., *Hyperaspis usambarica*, Wse., *Alesia amoenula*, Gerst., *Chilocorus distigma*, Klug, and *C. calvus*, Wse., preyed on *Aphis tavaresi* ; *H. usambarica*, *Exochomus sjöstedti*, Wse., and *Scymnus* (*Sidis*) *biguttatus*, Muls., on *F. virgata* ; and *C. distigma* and *Lotis bicolor*, Wse., on *Aspidiotus destructor*. *Lecanium* was parasitised by *Coccophagus trifasciatus*, Comp. [xiii, 134] and *Euplectrus bicolor*, Swed. ; *F. virgata* by *Leptomastix longipennis*, Merc. ; *A. destructor* by *Aphelinus chrysomphali*, Merc. ; and the larvae of *Argyroploce leucotreta* by an Ichneumonid, *Pristomerus* sp.

Borg (P.). [Report of the] **Plant Pathologist.**—*Ann. Rep. Dept. Agric. Malta 1932–33*, pp. xiv–xviii. Malta, 1933.

As the result of repeated treatments with potassium sulphide, *Scolytus rugulosus*, Ratz., is now well under control in the areas in which it was first observed after its introduction into the Maltese Islands over 20 years ago. Two severe outbreaks occurred during 1932–33, one being particularly serious on stone-fruit trees in Gozo. *Gryllotalpa gryllotalpa*, L. (*vulgaris*, Latr.) is proving injurious, particularly to root crops, and also to young crucifers. In one case rootlets of American vines were badly damaged. *Ceratitis capitata*, Wied., continued to be a serious pest of oranges. About 80 per cent. of the crop could have been saved by the destruction of fallen fruit and injections of carbon bisulphide into the soil to kill the pupae, but though these measures were practised in some groves, they were reinfested by migration throughout the season from neglected places in the vicinity. At a time when an increase in the numbers of the flies is most injurious to cultivated fruits, particularly *Citrus*, peaches and pears, ideal breeding situations are formed by numerous plantations of prickly pear [*Opuntia*]. Many of these are old and produce fruits unfit to eat, which are consequently left ungathered and are often very heavily infested [*cf. R.A.E.*, A, xx, 206]. Spraying with potassium permanganate and soil treatment with carbon bisulphide have proved very successful in the control of *Eriosoma lanigerum*, Hausm., on apple, and many of the Coccids common in gardens are comparatively easy to deal with by potassium permanganate sprays, but difficulty is still experienced with *Chrysomphalus dictyospermi*, Morg., on *Citrus* [*cf.* xix, 731]. Potassium sulphocarbonate gave the best results, but did not effect complete control. Contrary to expectation, colonies of *Rodolia* (*Novius*) *cardinalis*, Muls., were able to survive the severe winter conditions, being observed in several groves and orchards at the beginning of spring. *Phylloxera*, which was probably introduced about 1917, has now spread to all vineyards in Malta.

Campos R. (F.). **Insectos destructores de la caña de azucar.** [Insect Pests of Sugar-cane.]—*Rev. Col. Rocafuerte*, xiv, no. 46–47, pp. 7–8. Guayaquil, 1932. [Recd. September 1933.]

Diatraea saccharalis, F., is stated to occur on sugar-cane in Ecuador in association with an egg parasite, *Trichogramma* sp.

Campos R. (F.). **El gigantesco tabano** *Pantophthalmus bellardii* **Bell. Su larva afecta al arbol de cacao.**—*Rev. Col. Rocafuerte*, xiv, no. 46–47, pp. 17–19, 1 pl. Guayaquil, 1932. [Recd. September 1933.]

Pantophthalmus bellardii, Bell., has been found boring in cacao trees in Ecuador, this being an addition to the long list of trees known to be attacked by larvae of this genus of flies.

Campos R. (F.). **Algo sobre las pestes reinantes del Cacao.** [Some Notes on Pests of Cacao in Ecuador.]—*Rev. Col. Rocafuerte*, xiv, no. 46–47, pp. 79–90. Guayaquil, 1932. [Recd. September 1933.]

The pests recorded are : the Lamiids, *Oncideres* spp. and *Steirastoma depressum*, L. ; the leaf cutting ant, *Atta* (*Oecodoma*) *cephalotes*, L. ;

Heliothrips sp.; Sphingid larvae; Cicadids, *Proarna* and *Zammara* spp.; Cercopids, *Tomaspis* spp.; Membracids, *Aconophora* spp.; the Capsids, *Monalonium atratum*, Dist., and *M. dissimulatum*, Dist.; and the Flatid, *Ormenis albigyna*, sp. n., both sexes of which are described and which is very common on cacao, especially during the rainy season.

Blanchard (E. E.). **Contribución al conocimiento de los parásitos de** *Oeceticus kirbyi*, **Guild.**—*Rev. Soc. ent. argent.*, v, no. 24, pp. 277–294, 5 figs. Buenos Aires, May 1933.

Descriptions are given of *Ipobracon oeceticola*, Brèth. [*R.A.E.*, A, viii, 298, 299] and the new species, *I. allenense, I. longicaudatum, I. neuquenense, I. koehleri, I. sublucens, I. sollertum, I. psychidophagum*, and *Microbracon lizerianum*, all of which are endoparasites of the bagworm, *Oeceticus kirbyi*, Guild., in Argentina.

Blanchard (E. E.) & Carrera (C.). **Causas que originan pérdidas en los cultivos de trigos en el sur de la prov. de Buenos Aires, este y norte de la Pampa.** [Causes producing Losses in Wheat in the South of the Province of Buenos Aires and in the East and North of the Pampa Territory.]—*Bol. mens. Minist. Agric. Argent.*, xxxii, no. 1, pp. 3–10. Buenos Aires, 1933.

This paper includes notes on the weevil, *Prosaldius rufus*, Hust., infesting the stems of wheat in Argentina [*R.A.E.*, A, xix, 498; xx, 472]. The infestation did not appear to decrease the yield of grain, but weakened the stems mechanically.

Marchionatto (J. B.), Vallega (J.), Fresa (R.) & Chaudet (A.). **Acción langosticida de las emulsiones jabonosas.** [The Toxic Action of Soap Emulsions on Locusts.]—*Bol. mens. Minist. Agric. Argent.*, xxxii, nos. 1–2, pp. 11–21, 231–237. Buenos Aires, 1933.

These two papers describe experiments made in Argentina in which solutions of various soaps were found to kill hoppers of *Schistocerca paranensis*, Burm., and the second also deals with their preparation. Soaps containing resin were the most effective; two that killed the hoppers in less than an hour at concentrations of 2–2½ per cent. contained respectively linseed oil 40 parts, resin 17, caustic soda 11 and water 32, and fish-oil 45 parts, resin 20, caustic soda 8, and water 27.

Marchionatto (J. B.). **Una epizootia en la langosta voladora.** [An Epizootic in Adult Locusts.]—*Bol. mens. Minist. Agric. Argent.*, xxxii, no. 1, pp. 53–54. Buenos Aires, 1933.

After moist and cold weather in July 1932, many adult locusts [*Schistocerca paranensis*, Burm.] were killed in the province of Santa Fé, Argentina, by a disease resembling that produced by *Coccobacillus acridiorum*.

Watson (J. R.) & Thompson (W. L.). **Food Habits of** *Leis conformis* **Boisd. (Chinese Ladybeetle).**—*Florida Ent.*, xvii, no. 2, pp. 27–29. Gainesville, Fla., August 1933.

In the locality in Florida where *Leis conformis*, Boisd., has become established [*R.A.E.*, A, xxi, 411], it is now more abundant than any

native Coccinellid and is believed to be an important factor in the control of *Aphis spiraecola*, Patch, on *Citrus*. In the laboratory, adults and larvae fed readily on *A. spiraecola* and *A.* (*Rhopalosiphum*) *pseudobrassicae*, Davis, which were largely used in rearing the beetles, and on *A. gossypii*, Glov., *Brevicoryne brassicae*, L., and *Myzus persicae*, Sulz., besides being predacious on their own species and on various soft-bodied larvae. In the field, they were observed to feed on *Trialeurodes variabilis*, Quaint., on papaya, and the adults also on *Aphis maidis*, Fitch. The adults also fed on the flowers of *Erechtites hieracifolia* and *Crotalaria striata*, the pollen of saw palmetto (*Serenoa serrulata*), the tender terminal shoots of scrub oak and the sap from wounds on *Citrus*.

REINHARD (H. J.) & THOMAS (F. L.). **Ingestion of Poison by the Boll Weevil.**—*Bull. Texas Agric. Expt. Sta.*, no. 475, 33 pp., 6 figs., 25 refs. College Station, Tex., July 1933.

Previous attempts to control *Anthonomus grandis*, Boh., by means of various arsenicals are reviewed, and experiments are described, carried out in Texas during 1928–31, on the ingestion of calcium arsenate by the weevil [*cf. R.A.E.*, A, xvi, 637 ; xviii, 624].

The following is taken mainly from the authors' conclusions : Approximately 65 per cent. mortality occurred on dusted cotton as a result of the accumulation of poison on the mouth parts and accidental ingestion by weevils crawling on the stems, leaves or fruits of cotton. The particles deposited by a spray are not so readily picked up. To be most effective, the dust should be applied uniformly to all parts of the plants. The lethal dose of arsenic (0·004 mg.) approximates to the amount (0·0049 mg.) retained on the surface of a cotton bud after an application of calcium arsenate at the rate of 10 lb. of dust per acre. The presence of dust (talc) very greatly reduced the distance that the weevils crawled and the number of fruits they visited. As the presence of down on stems and leaves also retarded crawling and caused the proboscis to come into contact more frequently with the loose particles of poison retained, it is thought that the development of this character may facilitate the cultivation of the best strains of cotton in infested areas.

DYKSTRA (T. P.). **Weeds as possible Carriers of Leaf Roll and Rugose Mosaic of Potato.**—*J. Agric. Res.*, xlvii, no. 1, pp. 17–32, 8 figs., 17 refs. Washington, D.C., 1st July 1933.

In field experiments in Oregon [*cf. R.A.E.*, A, xx, 569] on the possible rôle of weeds as reservoirs of virus diseases of potato, both leaf-roll and rugose mosaic were apparently transmitted from infected weeds (*Datura stramonium* and *Solanum villosum*) to potatoes by insects naturally occurring on the latter. Rugose mosaic was experimentally transmitted by leaf-mutilation from potato to *S. villosum*, *Physalis* sp., tomato and *Petunia*, and the latent [mottle] virus, which is a component of this mosaic [xxi, 536], by inoculation also to *Datura* spp. and *Capsicum*. Of the various insects tested, none transmitted this virus from potato to *D. stramonium*, with the possible exception of *Philaenus spumarius*, L. *Myzus persicae*, Sulz., after feeding on potatoes infected with rugose mosaic, transmitted its other component (vein-banding virus) to potatoes not carrying the latent virus. This Aphid also transmitted leaf-roll from potato to *S. villosum*, *S. dulcamara*, *Datura* spp. and tomato.

Lockwood (S.). **The Relation of Weeds to Insect Pests.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 6, pp. 279–282. Sacramento, Calif., June 1933.

With a view to showing the value of the destruction of weeds, annotated lists are given of the more important insect pests of cultivated crops that hibernate among them in California, and of weeds that serve as food-plants for different pests.

Michelbacher (A. E.). **Chemical Control of the Garden Centipede,** *Scutigerella immaculata*.—*Bull. Calif. Agric. Expt. Sta.*, no. 548, 19 pp., 1 fig., 18 refs. Berkeley, Calif., December 1932. [Recd. September 1933.]

Various chemicals were tested in California for the control of *Scutigerella immaculata*, Newp. [*cf. R.A.E.*, A, xx, 357], in an infested field, which was divided into experimental plots by water-filled ditches. They were applied during the summer, with soil temperatures ranging from 63 to 97°F. at 3 ins. below the surface and from 64 to 80°F. at 10 ins. Infestation at this time was chiefly confined to the upper 9 ins.

Paradichlorobenzene appeared to give satisfactory control when sown in furrows at the rate of 600 or 900 lb. per acre, but not at 300 lb. It was slow in action, but its toxicity apparently lasted until the soil was completely freed from infestation. Carbon bisulphide injected into the soil at 18-inch intervals was effective when applied in sufficient quantity (145–290 U.S. gals. per acre). It apparently destroyed all animal life within 18 hours. An emulsion containing 65 per cent. carbon bisulphide, diluted with 300 parts water and applied at the rate of 5 U.S. gals. per sq. yd., did not prove efficient in the field, though similar treatment has given satisfactory results in greenhouses [*cf.* xvi, 124.]. It is only effective when the infestation is confined to the upper layers of the soil, and when the latter is porous and moist. Unlike the other two, it can sometimes be safely used in soil containing growing plants. Adequate control was not obtained with any of the following, the rates of application per acre being shown in brackets : calcium cyanide (300–900 lb.), naphthalene (1,200 lb.), lead arsenate (300 lb.), carbon tetrachloride (290 U.S. gals.), chloropicrin (280 lb.), or mixtures of equal parts of lime and sulphur (1,200 lb.), or lime and potassium xanthate (2,400 lb.). Chemical control of *S. immaculata* is economically justifiable only in small areas and in greenhouses.

Severin (H. H. P.). **Field Observations on the Beet Leafhopper,** *Eutettix tenellus* **in California.**—*Hilgardia*, vii, no. 8, pp. 281–350, 23 figs., 8 pls., 45 refs. Berkeley, Calif., January 1933. [Recd. September 1933.]

A detailed description is given of field observations on *Eutettix tenella*, Baker, made in California, collating the work of the author and others during the years 1918–32.

Lamiman (J. F.). **Control of the Grape Leafhopper in California.**—*Circ. Calif. Agric. Ext. Serv.*, no. 72, 20 pp., 13 figs., 1 ref. Berkeley, Calif., February 1933. [Recd. September 1933.]

In view of the severity of attacks of *Erythroneura comes*, Say, on vines during 1928–31 in California, where it has been known to occur

since 1875, investigations were carried out on its control during 1931 and 1932 [*cf. R.A.E.*, A, xxi, 165]. In seasons in which it is abundant, this leafhopper is responsible for the loss of 25–30 per cent. of the crop of grapes ; in the winter of 1931–32, 100–1,800 adults were found per sq. ft. of débris. The eggs are laid in the epidermis of both surfaces of the leaves and hatch in 17–20 days in spring and more rapidly in summer. The nymphs feed only on the lower surface and require 2–3 weeks to complete their development.

The standard spray of nicotine sulphate was most effective at the rate of 1 U.S. pint to 100 U.S. gals water, with ½ lb. casein spreader or ½ U.S. gal. liquid whale-oil soap [*cf.* xxi, 166] ; it gave 95–97 per cent. control of the first-brood nymphs and showed a slight indication of killing the eggs. Pyrethrum extracts in water caused 93–95 per cent. mortality in 1932. These liquid sprays provide the best method of controlling the nymphs, if applied to the lower surface of the leaves when they are most numerous (usually from 20th May to 1st June in the centre of the State) at the rate of 100–200 U.S. gals. per acre, preferably by means of a power sprayer capable of maintaining 200–500 lb. pressure. They are not effective against the adults and cannot be used when injury to the " bloom " of the grapes is possible, but their chief limitation is slowness of application, 4–8 acres per day being the maximum area covered with 2–4 nozzles. They will be most valuable when used in combination with other materials against pests such as red spider [*Tetranychus pacificus*, McGregor]. Equipment has recently been developed for the vaporisation of concentrated insecticides. Of these sprays, one consisting of oil and pyrethrum extract proved effective against both nymphs and adults, especially the latter when they were forced to fly through the vapour. The formula was 87½ gals. highly refined kerosene, 10 gals. neutral oil (90 per cent. unsulphonatable residue and 60 secs. Saybolt viscosity) and 2½ gals. petroleum oil extract of pyrethrum, containing 2 gm. pyrethrins per 100 cc. The concentration of the extract is equivalent to 20 lb. flowers containing 0·9 per cent. pyrethrins per lb. to 1 U.S. gal., but as even the best grade of pyrethrum flowers may vary from 0·2 to 2·3 per cent. pyrethrins per lb., the weight of flowers per gallon is not a satisfactory standard. When applied at the rate of 2 U.S. gals. per acre from 15th to 17th April 1932 with a paint gun type of nozzle, the spray killed 87–90 per cent. of the overwintered adults, but at the rate of 5 U.S. gals. per acre in early August, when as many as 18,000 adults were present per vine, it killed only 35 per cent. Further treatment may be necessary if migration to the vines continues.

A calcium cyanide dust may be applied against the overwintered adults in a trap crop (barley or rye) or after they have concentrated on the vines in early spring, and this is the most successful treatment for late summer. In the open, the dust should be applied when the smoke of a smudge fire is observed to settle or only drift very slowly, and a coarse grade should be used, but when conditions necessitate application under tents (of light drill or cotton, 15 by 60–120 ft.), a fine grade is required. The rate of application is 20 lb. per acre. In 1931, vineyards treated in the first two weeks of April remained free from injurious numbers of leafhoppers throughout the entire season, and in 1932, 90–95 per cent. control was obtained in July of adults present in numbers ranging from 10,000 to 33,000 per vine. A dust, consisting of 80 lb. lime to which was gradually added 10 lb. nicotine sulphate (40 per cent.) and (after stirring for 5 minutes) 10 lb. sodium carbonate as

an activator, gave 92–95 per cent. control of active nymphs, but was only effective against the first three nymphal instars. Applications should be made at the rate of 15–20 lb. per acre and are most satisfactory at 90°F. or more, with a minimum of wind and where vineyards have been irrigated before treatment to reduce convection currents. A second treatment within about 2 weeks may be necessary for complete control.

Mechanical suction machines or air sweepers reduced the number of adults (which must be dislodged by shaking the vines) by 30–70 per cent. Parasitism by *Anagrus epos*, Gir., was first observed in 1932 early in July, and by 15th August 50–60 per cent. of the third-brood eggs were attacked. Though this Mymarid greatly reduces the number of leafhoppers entering hibernation, it probably occurs in numbers too late in the summer to be an efficient check. A seasonal programme of control measures is given ; calcium cyanide dust or pyrethrum oil sprays applied early in the spring against the adults after they have migrated to the vines, and nicotine or pyrethrum sprays or nicotine dust applied twice against the nymphs are considered sufficient for practical control.

Bailey (S. F.). **The Biology of the Bean Thrips.**—*Hilgardia*, vii, no. 12, pp. 467–522, 8 figs., 3 pp. refs. Berkeley, Calif., June **1933.**

An account is given of investigations in California on the biology of *Hercothrips fasciatus*, Perg., with notes on its distribution elsewhere, descriptions of all stages, and a list of the numerous plants on which it occurs. Beans, cotton and pears are the crops most commonly attacked, and prickly lettuce (*Lactuca scariola*) is the preferred wild food-plant. In central California, the adults remain almost inactive from November to March on the lower surface of the leaves of plants such as filaree [*Erodium*] that remain green and afford shelter [*cf. R.A.E.*, A, xvii, 357]. Many are killed by driving rains. Feeding and oviposition begin in the spring on prickly lettuce, filaree, sow-thistle (*Sonchus oleraceus*), etc., and the eggs hatch in about 20 days. The larvae, which are found in small numbers by the end of April, complete their growth in about 3 weeks ; and the prepupal and pupal periods in the soil occupy 10 days or more, the adults beginning to appear by the end of May. Second-brood larvae can be found about 1st June, and this generation develops in about a month ; subsequent generations (until August) are completed in about 3 weeks. Soon after 1st October, with the advent of cool, damp weather, the larvae rapidly disappear. There are normally 6–7 generations a year.

Females are usually about twice as abundant as males, and parthenogenesis occurs, the progeny being males. In the laboratory, adults supplied with food and water lived 15·7 days, which is somewhat less than the average period in the field. The larvae are found more frequently on the lower surface of the leaves than on the upper, and feed much more than the adults. Investigations showed a 60 per cent. mortality during the period passed in the soil, especially before the full-grown larvae transform to prepupae. A brief account is given of a detailed study carried out over three seasons on the seasonal history of the thrips in pear orchards.

Dry weather in autumn or spring, owing to its effect on the wild food-plants, is unfavourable to the thrips. During dry years or in

localities that are semi-arid, the drying up of the native vegetation in June causes the newly emerged adults to migrate to beet, lucerne, beans, pears, cotton, etc., where in hot, dry weather reproduction is rapid and severe damage is caused, particularly in non-irrigated areas.

Natural enemies include the predacious Anthocorid, *Orius* (*Triphleps*) *tristicolor*, White, which attacks *H. fasciatus* in the absence of *Frankliniella* spp. and in certain localities effects a considerable check on infestations. In the laboratory, adults consumed about one larva an hour and nymphs appeared to be even more voracious. Adults have lived 2 weeks in confinement, and the nymphal stage lasts about 10 days in summer. *Thripoctenus russelli*, Cwfd., is probably even more important, being particularly numerous in September and October with the decline in thrips population. Larvae parasitised by this Eulophid usually transformed to prepupae before dying. The egg and larval stages together averaged about 7·5 days and the pupal about 14 during June–July 1931. Adults kept at a constant temperature of 30°F. for as long as 5 days were capable of ovipositing on removal. Larvae of *Hippodamia convergens*, Guér., and *Chrysopa californica*, Coq., attack the first larvae of *Hercothrips* appearing in the spring ; those of *Aeolothrips fasciatus*, L., prey upon the larvae and adults, completing their growth in 2–3 weeks and pupating in the shelter of curled leaves or débris near the food-plants ; and those of *A. kuwanai*, Moult., prey on the eggs and larvae, pupating on the plant in curled leaves, abandoned spiders' webs, etc. None of these four species is of any great importance.

The adults of *H. fasciatus* were found to be most active between about 50 and 117°F., with an optimum of about 75–90°F. The surface temperature of the soil has a marked influence on emergence, and there is a considerable mortality of adults emerging on hot days from unshaded areas. The optimum for inactive or hibernating adults appears to be about 40°F., complete mortality resulting in 2–4 days at constant temperatures below 32°F. The rate of development of the larvae increased directly with the rise in temperature ; the optimum appears to be 80°F., and development ceases at 50°F. The larvae usually dropped to the ground to pupate at times in the morning and evening when the temperature of the soil surface was not high enough to kill them. The pupal period decreased with a rise in the temperature from 60 to 100°F., the optimum being 80–90°F. ; other temperatures are fatal. In the field, thrips were found in the soil at a depth of 3–6 ins. ; in experiments no larvae pupating within 3 ins. of the surface in unshaded areas survived. *H. fasciatus* is less affected by humidity, except that the egg stage requires a high, uniform degree of it. For the adults, the optimum appears to be somewhat less than 40 per cent., but the development of the larvae and pupae was scarcely affected by relative humidities ranging from 22 to 60 per cent. at 90 and 100°F. The pupae and adults showed little resistance to submersion in water, but the latter swam readily.

Plank (H. K.). **Removal of Spray Residue from Canning Peaches Sprayed for Peach Twig Borer Control.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 113–130, 5 figs., 2 refs. Sacramento, Calif., 1933.

The following is largely taken from the author's summary and conclusions : In northern California, many canners will not accept peaches

to which sprays for the control of *Anarsia lineatella*, Zell. (peach twig borer) have been applied within 60 days of harvest. This results, in cases of heavy infestation, in much damage that could otherwise have been prevented. Tests were therefore carried out in the summer and autumn of 1932 to determine the amount of arsenical and lead residue remaining at every stage in the process of canning on fruit sprayed 1–4 times during the growing and ripening season (6th June–23rd August) with 3 lb. basic lead arsenate and $\frac{2}{3}$ lb. of a colloidal spreader to 100 U.S. gals water [*cf. R.A.E.*, A, xvi, 254]. In view of the theory that in the process of softening the peel by a 1 per cent. solution of sodium hydroxide in water, the fruit is contaminated by large quantities of residue collecting in the bath, basic lead arsenate and spreader equal in amount to any possible accumulation were added before the beginning of the experiment, one bath containing as much as 0·23 per cent. arsenic trioxide. A mid-summer and a late-maturing variety of peach were employed, and the tests were carried out 5–14 days after the application of the last spray, the initial residue on all fruits (except one lot that had received only one application) exceeding 0·01 gr. arsenic trioxide per lb. and amounting to 0·072 gr. per lb. on one variety sprayed four times.

Analyses showed that though the concentrated accumulation of spray material was carried out of the sodium hydroxide bath, it was completely and easily removed during washing, and that fruit in further stages of canning contained no arsenic. Of 14 samples of fruit examined after 5 months, practically all, including peaches used in the experiments and others canned for the market, were found to be free from lead residue. One sample that had received three sprays, the last of which was applied 5 days before harvest, was found to contain 0·007 gr. lead per lb., the tolerance at the beginning of the 1933 shipping season being 0·014 gr. [xxi, 475].

SALMAN (K. A.). **Forest Insects of the Year 1932.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 131–137, 2 figs. Sacramento, Calif., 1933.

Lepidoptera that defoliate brushwood in California include *Vanessa* (*Aglais*) *californica*, Boisd., on *Ceanothus* [*R.A.E.*, A, xx, 698] and *Malacosoma fragilis*, Stretch, which is often abundant on *Purshia tridentata* and other shrubs affording pasture to sheep and deer. Larvae of the latter caused considerable injury in 1930 but were scarce in 1932.

Direct loss of timber caused by defoliating or sucking insects is seldom of great importance, but the Tineid, *Recurvaria milleri*, Busck (lodgepole needle-miner) [*cf.* ix, 391], which contributed to the injury suffered by lodgepole pine [*Pinus contorta* (*murrayana*)] from 1918 to 1921 during an outbreak of *Dendroctonus monticolae*, Hopk., was found to have markedly increased in one locality in 1932, and the Coccid, *Xylococcus macrocarpae*, Colem., severely infested pole-stands of incense cedar [*Libocedrus decurrens*] in one region, where it was preyed on by large numbers of the Coccinellid, *Hippodamia convergens*, Guér., early in the season. Other pests of incense cedar were *Phloeosinus fulgens*, Swaine [xii, 406], which appeared to be the primary cause of death of trees, and *P. punctatus*, Lec. (western cedar bark beetle), which caused heavy losses of young plants. Infestation of white and red fir [*Abies*] by *Scolytus ventralis*, Lec. (fir engraver beetle), was apparently less

severe in the Sierra region than in the previous year, the Braconid parasite, *Coeloides brunneri*, Vier., being extremely abundant ; in parts of other forests, however, the losses appeared to be heavier. *Ips emarginatus*, Lec., and *I. confusus*, Lec., continued to be minor pests of *Pinus ponderosa* ; the latter, which normally breeds in wind-thrown trees and logging slash, or at the most only in the tops of green trees or in seedlings, was unusually abundant in 1930–31 and infested entire trees. *Dendroctonus jeffreyi*, Hopk., was unusually destructive to *Pinus jeffreyi* in 1932, particularly in mixed stands, causing volume losses of nearly 3½ per cent. in some areas. Such severe losses have seldom been experienced except in the presence of fallen trees [*cf.* xviii, 321]. *D. monticolae* has strikingly increased in importance on sugar pine [*P. lambertiana*], killing 40 per cent. of the marketable trees since 1931 in the most severely infested area. It also attacked *P. ponderosa* rather more severely than usual, completely eliminating it over several acres from a mixed stand. *D. brevicomis*, Lec. (western pine beetle), the most important pest of *P. ponderosa* in California, was less abundant in areas where damage had been extremely severe in the previous year, but was more numerous elsewhere. In one area of about 682,000 acres, it caused a loss estimated at about £64,800 [at par]. Recent examinations have shown that the extremely low temperatures in December in the north-eastern part of the State have resulted in an average mortality of 65 per cent. of the brood within the bark of infested trees.

The loss caused by forest insects during 1932 is estimated at not less than 15 hundred million board feet.

Cook (W. C.). **Spraying for Control of Beet Leafhopper in central California in 1931.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 138–141. Sacramento, Calif., 1933.

Experiments were carried out in California on spraying against *Eutettix tenella*, Baker (beet leafhopper) when it is concentrated on patches of perennial plants after the autumn migration from the beet areas and before the winter food-plants germinate. A spray of fuel oil and pyrethrum (the extract of 1 lb. flowers to 2 U.S. gals. spray) was applied undiluted at an average rate of about 5 U.S. gals. per acre by means of atomising nozzles. Promising results were obtained, of which those for the three principal areas constituting sources of sugar-beet infestation are tabulated. Sweep-net counts in autumn showed that the spray had produced mortalities of 85, 60 and 50 per cent. respectively ; next spring the numbers found in the foothill breeding grounds, which should theoretically (in the absence of control measures) have been twice as great in 1932 as in 1931, were only 0·35, 0·8 and 1 times as great, and on sugar-beet after the spring migration they were 0·32–1·24 times as great as in 1931.

Latta (R.) & Cole (F. R.). **A Comparative Study of the Species of *Eumerus* known as the Lesser Bulb Flies.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 142–152, 2 figs., 12 refs. Sacramento, Calif., 1933.

The adults of both sexes of *Eumerus strigatus*, Fall., *E. tuberculatus*, Rond., and *E. narcissi*, Smith [*cf. R.A.E.*, A, xvi, 434] are described, with a key, and characters by which the species may be distinguished in the field are indicated.

Essig (E. O.) & Keifer (H. H.). **A Pest of Sierra Plums.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 153–155, 1 fig., 6 refs. Sacramento, Calif., 1933.

Descriptions are given of the larvae of *Mineola scitulella*, Hulst [*cf. R.A.E.*, A, xx, 695], which destroyed at least half a crop of wild Sierra plums (*Prunus subcordata*) in northern California, feeding throughout the pulp and also probably attacking the foliage, and of two other Pyralids, *M. indigenella*, Zell., and *Ambesa mirabella*, Dyar, with which they might be confused. Of these, the former attacks plums and the latter prunes in California.

Cartwright (W. B.), Blanchard (R. A.) & Wilson (C. C.). **Notes for 1932 on Cereal and Forage Insects in California.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 156–160. Sacramento, Calif., 1933.

Some damage was caused to the grass on ranges by *Tipula quaylei*, Doane, *T. simplex*, Doane, and other Tipulids, which also attacked lucerne and were controlled by baits of Paris green and bran. Various grasshoppers were major pests of the ranges, notably *Camnula pellucida*, Scudd., which is commonest in mountain meadows [*cf. R.A.E.*, A, xxi, 516], and *Aulocara femoratum*, Scudd., *Oedaleonotus enigma*, Scudd., and *Hippiscus californicus*, Scudd., which are of economic importance on the lower foothills and sometimes migrate to cultivated crops. In 1931 and 1932 the two last invaded grain fields in damaging numbers, and were abundant on lucerne in one district, where many nymphs were killed by the predacious Carabid, *Callisthenes latipennis* var. *opimus*, Casey. Repeated experiments have shown attractants to be unnecessary in baits for grasshoppers, good results being obtained with a mixture of either ½ lb. Paris green, ¾ lb. commercial arsenic, ½ lb. powdered sodium arsenite or ½ U.S. pint liquid sodium arsenite, with 25 lb. red wheat bran and 3½ U.S. gals. water.

Acyrthosiphon onobrychidis, Boy. (*Illinoia pisi*, Kalt.) destroyed or reduced the market value of the first crop of lucerne in one area. In another a good first crop was obtained by burning over badly infested fields after 12th March, but the cost of portable oil burners has proved prohibitive, except when the price of hay is above normal. Other control measures are recommended [xiv, 653]. Dusting with undiluted calcium arsenate (20 lb. per acre) was the measure most widely adopted against *Prodenia praefica*, Grote [xx, 694] after it had migrated from lucerne to adjacent vegetable crops, but apparently did not always effect control, most of the larvae in many dusted fields being killed by a bacterial disease. The residue left on bean straw was judged to be a possible source of danger to sheep and other grazing animals.

In addition to *Hypera variabilis*, Hbst. (*postica*, Gyll.) [xx, 644; xxi, 516], *H. punctata*, F., caused some damage to lucerne. A fungous disease appears to be the most important factor in its control in this State. Serious damage to the first crop in late March and early April by *Bryobia praetiosa*, Koch, was terminated by the advent of warm weather. Rather widespread damage was caused to the fifth crop by *Colias* (*Eurymus*) *eurytheme*, Boisd. It may be minimised by keeping the soil moist to induce the development of a bacterial disease that attacks the larvae. In one treatment of a field with a special type of insect-dozer, 50–65 per cent. of the larvae were collected, and in two

treatments 80–83 per cent. Lucerne and other plants should not be allowed to flower in uncultivated areas as they are then a source of food for the butterflies.

WRIGHT (W. H.). **Walnut Aphis Control.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 166–169. Sacramento, Calif., 1933.

The walnut Aphis [*Chromaphis juglandicola*, Kalt.] has 8–10 generations annually on walnut in California, the parthenogenetic females laying 25–35 eggs on the lower surface of the leaves. Males appear in autumn, and the fertilised eggs overwinter. Heavy infestations lower the quality of the entire crop and cause a reduction in yield the following year. When the outbreak is slight and there are not more than 6 individuals per leaflet, control may be obtained by the application of a dust of 3 per cent. nicotine sulphate [*cf. R.A.E.*, A, viii, 130 ; x, 286], which should be repeated when the numbers begin to increase again ; heavily infested trees should be dusted twice at an interval of 2–3 weeks with a 3½–4 per cent. dust.

The benefits obtained as a result of yearly applications of basic lead arsenate against the codling moth [*Cydia pomonella*, L.] on walnuts [*cf.* xiv, 407 ; xx, 637] are indicated in tables containing data on a total of 702 orchards. A summary of results from 1927 to 1932 shows that the average percentages of infested nuts were 2·3, 6·8 and 7 in sprayed, dusted and untreated orchards, respectively. The same orchards were not necessarily sprayed, or left untreated, every year. An average infestation of 75 per cent. in three untreated orchards in 1931 was reduced by spraying to 1·8 per cent. in 1932.

LOCKWOOD (S.). **A Review of Codling Moth Control Measures.**—*Mon. Bull. Dept. Agric. Calif.*, xxii, no. 2–3, pp. 170–178, 21 refs. Sacramento, Calif., 1933.

The codling moth [*Cydia pomonella*, L.] is comparatively easy to control on apple and pear in California, partly owing to the harvesting of many varieties of its food-plants before the appearance of the later broods. Since, however, a substitute for lead arsenate in late cover sprays is sometimes desirable in order to avoid spray residue, an outline is given from the literature of the work recently effected in the United States on a number of alternative spray materials. For those with equipment for washing their fruit, it is recommended that the lead arsenate in the second cover spray be reduced from 3 to 2 lb. per 100 U.S gals., followed on late-ripening fruits by a third cover spray of ¾ pint nicotine sulphate and 1 gal. oil in 100 gals. water [*R.A.E.*, A, xix, 544]. Where the fruits are only to be wiped, oil-nicotine should be used for the second cover spray also.

GINSBURG (J. M.). **Laboratory Tests with various Fumigants on Codling-moth Larvae.**—*J. Agric. Res.*, xlvi, no. 12, pp. 1131–1136, 8 refs. Washington, D.C., 15th June 1933.

Laboratory experiments were carried out in New Jersey on the toxicity of various fumigants to larvae of the codling moth [*Cydia pomonella*, L.], with a view to the possible use as a control measure of fumigation of apple trees in the dormant stage. Of the fumigants tested, which were all applied in liquid form and allowed to vaporise in the fumigating chamber, ethylene chlorhydrin and hydrocyanic acid

were the most toxic, the minimum doses required to kill 75 per cent. of larvae removed from their hibernacula after one hour's exposure at laboratory temperatures (68–76°F.) being 20 and 30 cc. respectively per 100 cu. ft. of space. The minimum doses in cc. of the others were: diethylene oxide, 115; ethylene oxide, 143; ethylene dichloride, 215; carbon bisulphide, 286; and ethyl acetate, 572. The order of toxicity to larvae in hibernacula was approximately the same, but the minimum doses were considerably larger. Above 50°F. and below 40°F. respectively, the doses of ethylene chlorhydrin required to kill 100 per cent. of naked larvae were 30 and 70 cc., and of larvae in hibernacula 40 and 140 cc. The toxicity of hydrocyanic acid was similarly affected by temperature.

HOUSER (J. S.). **The Wheat Field Insect Survey—1933.**—*Bi-m. Bull. Ohio Agric. Expt. Sta.*, xviii, no. 164, pp. 119–122, 2 maps. Wooster, Ohio, 1933.

Despite the high rate of infestation of wheat by the Hessian fly [*Mayetiola destructor*, Say] in Ohio in 1932 [*R.A.E.*, A, xx, 676], no severe damage was caused owing to the unusually vigorous growth made by the plants. In 1933, the rate throughout the State averaged 8·1 per cent. and, in view of the activities of the pupal parasites, no great damage to the crop sown in the autumn is expected, though any wide deviation from the suggested dates of sowing is inadvisable.

FICHT (G. A.). **A Progress Report on some Insecticides used against the European Corn Borer.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 747–754. Geneva, N.Y., August 1933.

Experiments from 1928 to 1932 with insecticides against *Pyrausta nubilalis*, Hb., on maize in Indiana [*cf. R.A.E.*, A, xix, 476] have not resulted in the discovery of any entirely satisfactory treatment. Owing to its rapid growth at the time (July) when the applications were made, the maize was generally liable to injury by any treatment capable of seriously reducing borer infestation. Barium and calcium fluosilicates and lead arsenate proved less effective as dusts than in spray form. Hydrated lime and talc have been unsatisfactory as mechanical barriers to young larvae or deterrents to oviposition, 15·6 eggs per plant being found on plants dusted 4 times with the former, as against 20·16 on controls. Emulsions containing 1 per cent. neutral white oil, pine oil or linseed oil required 3 applications to reduce the infestation by 70 per cent., kerosene and cottonseed oil being even less effective, and neither nicotine, pyrethrum nor derris added appreciably to the effectiveness of the oil emulsions. These materials were also unsatisfactory when used alone or in other combinations. Three applications of acid lead arsenate (4 lb. to 100 U.S. gals) gave a reduction of only 47·8 per cent., but when combined with an oil emulsion gave reasonable control (over 60 per cent.) [*cf.* xx, 133]. Barium fluosilicate (2 lb. to 100 U.S. gals.) alone or in combination with dilute oil emulsions (2 qts. to 100 gals.) gave marked reductions (over 70 per cent.) but these were accompanied by some injury [*cf.* xix, 484]. Calcium fluosilicate, two applications of which at a concentration of 10 lb. to 100 U.S. gals. gave 73·7 per cent. reduction, appears to be the most satisfactory of the insecticides tested.

HUBER (L. L.) & POLIVKA (J. B.). **Some Ecological Aspects of European Corn Borer Abundance.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 755–758. Geneva, N.Y., August 1933.

In view of the probable correlation between the abundance of *Pyrausta nubilalis*, Hb., and the yield of maize [*cf. R.A.E.*, A, xvi, 393; xviii, 38], the latter is reviewed for the periods 1909–1931 and 1893–1932 in Ontario and Ohio respectively [xxi, 230]. From the discovery of the borer in Ontario in 1920 to the time when heavy losses occurred in 1926, its numbers had increased steadily, and similar records from Ohio suggest a fairly rapid increase up to and including the same date. It appears that, on the whole and especially since 1926, ecological conditions (as gauged by maize yield) have been relatively unfavourable to the borer in Ohio, and high populations have persisted only in isolated areas or on ecological islands; since 1927, there has been a continued tendency toward maintaining a rather low population in Ontario also. From the observations made, it is predicted that *P. nubilalis* will cause serious losses in wide areas when conditions are normal or above for a period of 2 or more years in succession, such losses being liable to occur even in the first year if the overwintering population is sufficiently high. When an unfavourable year follows a favourable one, the borer population will probably tend to maintain the same level, but if the second and succeeding years are also below normal, it will show a significant decrease.

SMYTH (E. G.). **Technique in the Mass Production of** *Trichogramma*.—*J. Econ. Ent.*, xxvi, no. 4, pp. 768–774, 1 pl. Geneva, N.Y., August 1933.

An account is given of a simple method for rearing *Trichogramma* developed in the course of three years' experience in its utilisation against *Diatraea saccharalis*, F., on sugar-cane in Peru. As a result of mass-colonisations of parasites reared in this way, the borer damage was so reduced that the purity and sucrose of the cane (and consequently the sugar content) was much higher than in uncolonised fields. This was ascertained from official figures of total yields and not from small samples. The method has been found economically sound, and its use is being extended.

Eggs of *Sitotroga* [*cerealella*, Ol.] for parasitism are secured to the inside of a glass jar by means of a solution of gum arabic, preserved by the addition of sodium benzoate. The adhesive is painted in intersecting strips, so that the behaviour of the parasites may be observed in the unpainted squares. One jar may contain 250,000 eggs. A minute or so after the adhesive has been applied, the eggs are introduced, the cover is clamped on and the jar is shaken. It is afterwards left open for the adhesive to dry and is then inverted over a similar jar containing eggs from which parasites are about to emerge. The jars are fastened together with adhesive tape, and placed in diffused artificial light in a temperature of 29°C. [84·2°F.], that containing the unparasitised eggs uppermost, as the parasites crawl upward. Alternatively, the jars may be placed horizontally, that containing parasitised eggs being covered with dark cloth. After 24 hours, the parasites are attracted back by means of strong light into the jar in which they emerged, and this is detached and covered with filter paper in readiness for liberation, which is effected by walking down the windward side of a cane-field with the jar uncovered. The average parasitism in the jar is

calculated by counts of the eggs within 4 small rectangles inscribed on the outside.

After separation, the jar containing fresh eggs is inverted over another containing fumigated maize [but *cf. R.A.E.*, A, xxi, 334] and left for 6 days. When the remaining unparasitised eggs have hatched, the larvae are returned to the breeding room, while such parasites as remain in the jar continue ovipositing. The avoidance of loss of unparasitised host-eggs is important. If the weekly production of *S. cerealella* is a million eggs, the weekly recovery of larvae from unparasitised eggs will be about 300,000. As it requires only about 200,000 moths to produce a million eggs, egg collections can continue indefinitely until the grain is exhausted.

After removal from the jars of maize, the jars of newly-parasitised eggs, covered only with filter paper secured with rubber bands, are laid with the bottom toward the window at 27–29°C. [80·6–84·2°F.] until adults begin to emerge. Between 80·6°F. (night) and 87·8°F. (day), the strain of *Trichogramma* native to the coastal districts of Peru develops in only 8–9 days, but a slight lowering of the temperature may lengthen the life-cycle by several days. Excessive humidity, which is apt to result when too direct a source of light is used during oviposition, is specially to be avoided.

STEINER (L. F.) & YETTER, jr. (W. P.). **Second Report on the Efficiency of Bait Traps for the Oriental Fruit Moth as indicated by the Release and Capture of marked Adults.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 774–788, 1 fig., 2 refs. Geneva, N.Y., August 1933.

The following is taken from the authors' abstract and conclusions: Tests of bait-traps against *Cydia* (*Grapholitha*) *molesta*, Busck, were continued in Georgia in 1932 [*cf. R.A.E.*, A, xx, 135, 294]. Of 1,144 marked moths released on 33 different days before peach harvest in a 16-acre orchard baited with 400 traps, 76·4 per cent. were caught in the traps, and the females had deposited nearly 14 per cent. of their eggs. Of 200 released before harvest in a 37-acre orchard baited with 2,200 traps, 89 per cent. were caught, and the females had deposited 3·6 per cent. of their eggs. Reductions of 60–80 per cent. in the number of infested fruits were obtained in these orchards, despite evident migration from more than 1,000 acres of surrounding unbaited orchards. After harvest, the percentage of moths recovered from releases diminished, owing in some instances to migration out of the baited orchards before oviposition. Of 492 moths released on 17 different days after harvest in the 27-acre orchard, only 41 per cent. were recaptured, and the females had deposited 17·5 per cent. of their eggs. It appears that the use of 1 trap to 2 trees permits less oviposition before capture than the use of 1 to 4. The reduction in fruit injury in the larger baited orchard was greater than in the smaller one.

Following the release of 1,978 marked moths in unbaited peach orchards at distances varying from 75 yds. to 1¾ miles from the baited ones, 7 instances were observed of flights ranging between one and nearly two miles, 16 of more than ½ mile and 100 of more than ⅕ mile. A female that had flown at least 9,900 ft. deposited eggs after capture. Of moths released on four sides of the 27-acre baited orchard, ¼ mile from the nearest traps, 3·5–17 per cent. were recovered, and of those released on two sides of the 16-acre orchard, ⅛ mile from the nearest traps, 18·8 and 28·4 per cent.

The experiments indicate that large-scale bait-trapping should give satisfactory results and that baiting on a smaller scale may eventually become practicable if more efficient baits can be developed. A large number of different baits were used throughout the tests, many being less attractive than the sugar-solution containing terpenyl acetate that was used as a standard of comparison. Large-scale operations using 50 traps per acre (1 to 2 trees) cost about 30*s.* [at par] an acre for the season.

MERRITT (J. M.). **Oriental Fruit Moth Parasites in Michigan.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 788–792. Geneva, N.Y., August 1933.

Cydia (*Grapholitha*) *molesta*, Busck, was first reported in Michigan in the autumn of 1928, and during 1929 the following six parasites were obtained from it in the orchard in which it was originally found: *Aenoplex betulaecola*, Ashm., *Phygadeuon* (*Cryptus*) *alacris*, Cress., *Pimpla* (*Ephialtes*) *aequalis*, Prov., *Hoplocryptus incertulus*, Cush., *Idechthis nigrocoxalis*, Cush., and *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.).

Summarised data of the relative abundance of the 15 different species reared during 1930, 1931 and 1932 in neighbouring orchards show that *Glypta rufiscutellaris*, Cress., was the most important, representing over 80 per cent. of all parasites obtained; it produced an average parasitism of 25·2 per cent. over the three years, the total parasitism averaging about 30 per cent. The remaining parasites (with the percentage of their occurrence) were: *Cremastus minor*, Cush. (6·3), *Pristomerus ocellatus*, Cush. (1·7), *Cremastus forbesi*, Weed (1·6), *Macrocentrus delicatus*, Cress. (1·3), *Angitia* (*Dioctes*) *obliterata*, Cress. (1·3), *Ascogaster carpocapsae*, Vier. (0·7), *Microdus* (*Bassus*) *cinctus*, Cress. (0·13), *Ephialtes* (*Calliephaltes*) *grapholithae*, Cress. (0·13), *Cremastus tortricidis*, Cush. (0·26), *Pimpla* (*Epiurus*) *indagatrix*, Cress. (0·13), *Macrocentrus ancylivora*, Roh. (0·13), *Meteorus trachynotus*, Vier. (0·13), *Microbracon gelechiae*, Ashm. (0·13) and *M. mellitor*, Say (0·4). The species bred in 1929 are estimated to represent 2·9 per cent. of the total and to have parasitised an average of 0·9 per cent. of the larvae.

A study of the larval population of *C. molesta* in the orchard under observation for the same three seasons indicates that the second generation was considerably larger than the first, and was followed by a great decrease, with the result that the fruit infestation has never reached 2 per cent. Although this coincided with an increase in activity of the larval parasites, it cannot be attributed wholly to their activities.

HOCKENYOS (G. L.). **Effect of Dusts on the Oriental Roach.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 792–794. Geneva, N.Y., August 1933.

The following is the author's summary: A technique is described which was used to determine if very fine dust would enter the tracheae of *Blatta orientalis*, L. Neither submergence in a dust nor suspension in a dust-charged atmosphere caused dust particles to enter the tracheae. It is suggested that the loss of moisture might account for the injurious effect of inert dusts on some insects [*cf. R.A.E.*, A, xviii, 664].

WILDERMUTH (V. L.) & FRANKENFELD (J. C.). **The New Mexico Range Caterpillar and its Natural Control.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 794–798, 3 refs. Geneva, N.Y., August 1933.

Fluctuations in the abundance of *Hemileuca oliviae*, Ckll., for the past 50 years in New Mexico, where it attacks range grasses, are discussed. After a period of about 10 years, during which it remained unnoticed, this Saturniid was again observed in 1926, and by 1932 it had spread over the entire cattle range in the north-eastern part of the State. In the autumn of 1929, it was so numerous that a widespread attack was predicted for 1930, but in the following spring many of the eggs failed to hatch; it is believed that a blizzard combined with low temperatures occurring at the time of emergence prevented pairing, so that most of the eggs laid were unfertilised. Owing to drought, the remainder were late in hatching, and many of the larvae pupated before they were full-grown. The resulting females were weak and laid few eggs, so that the moths did not become widely distributed until 1932. The sudden disappearance of *H. oliviae* in past periods of outbreak has been found to be due to the egg parasite, *Anastatus semiflavidus*, Gah. [*cf.* *R.A.E.*, A, ix, 458; xx, 216]. The larvae are parasitised by *Tachina mella*, Wlk., and *Phorocera claripennis*, Macq., and the pupae by *Pimpla conquisitor*, Say, and *Brachymeria* (*Chalcis*) *ovata*, Say. Beetles predacious on both larva and pupa include *Calosoma obsoletum*, Say. As a biological control measure, attempts were made to introduce *Compsilura concinnata*, Mg., and the three predacious Carabids, *Calosoma sycophanta*, L., *C. lecontei*, Csiki (*lugubre*, Lec.) and *C. calidum*, F. *C. sycophanta* was reared and distributed in large numbers, but exerted only a minor influence in the control of the moth, and it was decided to concentrate on artificial rearing and colonisation of *A. semiflavidus*, which after reducing the numbers of its host becomes itself reduced to an almost negligible minimum. As the multiplication of the parasite during a period of outbreak of *H. oliviae* is always much later than that of the host, it was thought that artificial rearing and distribution would greatly reduce the period normally required for it to gain ascendency. Eggs of *H. oliviae* were found after considerable search and gave 1·6 per cent. parasitism. From these, large numbers of *A. semiflavidus* were rapidly reared and have been distributed throughout the infested territory during the past two years.

FRANKENFELD (J. C.) & BARNES (O. L.). **The Equipment and Methods used in Rearing the New Mexico Range Caterpillar Parasite** *Anastatus semiflavidus* **Gahan.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 799–805, 1 pl., 4 refs. Geneva, N.Y., August 1933.

A detailed description is given of the methods used in the mass production of *Anastatus semiflavidus*, Gah., for the control of *Hemileuca oliviae*, Ckll. [see preceding paper]. The work began in 1930 and was done in a laboratory in Arizona. Constant temperatures varying from 70 to 80°F. were maintained in the breeding room in winter by means of a thermal system; and it was also necessary to instal a cooling system. Two automatically controlled electric incubators were used for the parasitised eggs. The parasite oviposition cage is made of a stout wooden framework (16 × 16 × 15 ins.), with a wooden floor, one side consisting of hinged doors opening upward and downward. The lower door and the back are covered with cheesecloth and 16-mesh window screen; the remainder, with transparent celluloid. Each cage

accommodates 11 square egg-racks (held upright and about ¾ inch apart by a special device). The sides and bottom of each rack are made of wood, and the top is formed by a stout wire. The cylindrical egg-masses of the moth are slipped over smaller iron wires, 16 of which are tacked to the wooden base of the rack and hooked over the large wire at the top.

H. oliviae, which has one generation a year, deposits its eggs during September–November round grass or weed stems near the ground, and hatching occurs in the following May or June. As the eggs are tightly fastened to their support and the eggshells are very thick and durable, they are not difficult to handle. Large numbers are collected in north-eastern New Mexico by breaking the stem above and below the egg-mass and brought to the laboratory between October and March, where they are kept at 35°F. until required. It is estimated that each wire will support 1,250 eggs and each breeding cage will hold 200,000 eggs, allowing space for food-containers and boxes containing eggs from which parasites are emerging. The eggs are exposed to *A. semiflavidus* in the cages for 2 weeks, and when highly parasitised, are removed to the constant-temperature room for 3–4 days before being stored at 40°F. until needed for replenishing the cages or for field liberation.

A high percentage of parasitism has been secured with a temperature of 75°F. and an average relative humidity of 80 per cent., and good results have also been obtained with temperatures ranging from 72 to 79°F. In the field, *A. semiflavidus* probably produces only one partial generation a year [*R.A.E.*, A, ix, 458], but under controlled conditions six or more effective partial generations can be reared. The parasite has been reared from egg to adult in 21 days at 80°F. Under controlled temperature and moisture, as in the field, many of the fully-developed larvae remain in the host-egg for several months after emergence has apparently stopped. It has thus been impossible to work out a definite system of re-stocking cages, and the number of parasites has had to be determined by general observation aided by counts of representative egg-masses. If emergence is very rapid and a high concentration of females is seen in a cage, the stock material is removed to a new cage or to a cooler temperature to retard emergence. When it has become almost negligible, the remaining parasitised eggs are stored at 40°F. to be used later for liberation. Moistening the eggs occasionally with an atomiser apparently hastens emergence. Each cage is provided with 6 cotton plugs soaked in a solution of honey and water (1 : 3) and fastened to corks, which are suspended through openings in the top of the cage as food for the parasites and renewed every 3 days. Adult parasites have been kept alive for 3 months by this method, during which time one female has parasitised as many as 355 host-eggs. During the parasite rearing season (November to March), it is possible to obtain in this way 2,000,000 parasitised eggs of *H. oliviae* per month. Examination of liberated eggs, about 6,000,000 of which have been returned to north-eastern New Mexico, shows that 85–90 per cent. of the adult parasites have emerged.

LILLY (J. H.) & FLUKE (C. L.). **New Developments in the Control of the Cherry Case Bearer** (*Coleophora pruniella*, **Clem.**) **in Wisconsin.** —*J. Econ. Ent.*, xxvi, no. 4, pp. 805–812, 14 refs. Geneva, N.Y., August 1933.

An account is given of experiments with dormant sprays for the control of *Coleophora pruniella*, Clem., on apple and cherry in

Wisconsin, most of the results of which have been noticed from a briefer report [*R.A.E.*, A, xxi, 514]. It was found that successful control on apple depends on thorough spraying from the ground, as the cases are situated under the branches rather than concentrated about the crotches as on cherry; 89·5 per cent. mortality was obtained by a grower who applied a tar distillate at $3\frac{1}{3}$ per cent. strength in this manner.

Dormant petroleum oil emulsion sprays, though giving a high percentage of mortality, killed some of the fruit buds on apple, or (when applied in excess) entire spurs on both apple and cherry, and delayed and dwarfed development of foliage on apple.

Boyce (A. M.). **Influence of Host Resistance and Temperature during Dormancy upon the Seasonal History of the Walnut Husk Fly,** *Rhagoletis completa* **Cress.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 813–819, 4 figs. Geneva, N.Y., August 1933.

Data obtained during a biological study of *Rhagoletis suavis completa*, Cress. (walnut husk-fly) carried out from 1929 to 1932 in California show that the resistance of the food-plant, particularly varietal susceptibility, is directly related to hardness of the walnut husk during the oviposition period of the fly. The time at which the adults emerge depends on factors influencing termination of dormancy, among which accumulated temperature appears to be of prime importance. Data for the period 1928–32 show wide seasonal variations in adult emergence, but not in oviposition, the peak of which is reached between 25th August and 5th September. As the pre-oviposition period is normally 10–20 days and adults were present on the trees in great numbers for over 30 days in 1930 and 1931 before appreciable oviposition took place, it seems obvious that females were vainly attempting to oviposit until the husk softened sufficiently to permit of the insertion of the ovipositor. If this is true, one application of an insecticide at a fixed date would probably give adequate control.

Boyce (A. M.). **Control of the Walnut Husk Fly,** *Rhagoletis completa* **Cress.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 819–825, 1 fig., 2 refs. Geneva, N.Y., August 1933.

The more important data obtained during a study of *Rhagoletis suavis completa*, Cress. [*cf.* preceding paper] are summarised in relation to its control in California, to which it was introduced in 1926 from the central United States, where it is indigenous. About 97 per cent. of the Persian walnuts (*Juglans regia*) produced in the United States are cultivated in California, where over 100,000 acres of walnut trees are at present in bearing. Since 1927, when it first became a pest of major importance, the area infested by the fly has increased yearly, and in 1932 it covered about 500 sq. miles, including 2,000 acres of commercial walnut groves. The results obtained in laboratory tests of various insecticides in 1929–31 have already been noticed [*R.A.E.*, A, xx, 175, 692]. Of materials tested in dusts in 1932, which included certain arsenical, fluorine, nicotine and copper compounds, 50 per cent. synthetic cryolite or barium fluosilicate proved the most satisfactory; their adhesive qualities were greatly improved by the incorporation of 5 per cent. fish-oil, vegetable oil or mineral oil, especially the last-named. Both fibre talc and diatomaceous earth proved more satisfactory diluents than hydrated lime for these dusts, each possessing certain

advantages. Diatomaceous earth is very light, and more likely to be thoroughly distributed over the tree than a heavier material, and the incorporation of oil does not affect its dusting qualities. Tests showed that 5 minutes' continuous agitation of the toxic ingredient with the diluent was necessary before the oil was atomised into the hopper containing the mixture, and agitation for 10 minutes longer was required to distribute the oil properly through the dust mixture.

On the basis of data obtained with several insecticides in field control plots in 1928–32, the results of which are tabulated, and from general observations in commercially treated groves, the following formulae are recommended : 3 lb. synthetic cryolite (97 per cent. sodium fluoaluminate) or barium fluosilicate and 1 U.S. qt. mineral oil (95 seconds viscosity, 90 per cent. unsulphonatable) to 100 U.S. gals. water sprayed at the rate of 30–40 U.S. gals. to an average-sized walnut tree ; or 30 per cent. (by weight) synthetic cryolite or barium fluosilicate, 65 per cent. diatomaceous earth and 5 per cent. mineral oil dusted at the rate of 3–4 lb. to a tree. To ensure adequate protection within a grove, a zone of adjacent vegetation 50–100 ft. wide must be treated simultaneously. Two treatments are recommended, the first when adult emergence becomes regular and the second about 4 weeks later.

FARLEMAN (M. G.). **Observations on the Habits of Flies belonging to the Genus** *Rhagoletis*.—*J. Econ. Ent.*, xxvi, no. 4, pp. 825–828. Geneva, N.Y., August 1933.

Field observations in Michigan have shown that the species of *Rhagoletis* attacking cherry and apple appear on the trees earlier than in the cages that have hitherto been used to time the application of sprays for their control. The use of cages has therefore been discarded in favour of data taken direct from the orchards. *Rhagoletis fausta*, O. S., which chiefly attacks sour cherry, is the first to appear, followed directly by *R. cingulata*, Lw., which attacks both sour and sweet cherry. *R. pomonella*, Walsh, which attacks apple, appears 3–4 weeks later. In 1932, the first cherry fruit-flies appeared on 7th June in the south of the State and the last on 14th June in the extreme north, with appearances at intervening points in regular order.

Extensive sweepings of grass in infested areas during three summers did not yield many newly emerged adults, and sweeping of surface vegetation in cultivated orchards has been uniformly unproductive. The flies appear to be more readily found in warm, damp weather. More have been caught on the upper surfaces of the leaves on dull days, and on the lower on sunny days, and more on the middle third of the sunnier side than on any other part of the trees observed. *R. cingulata* has been found more commonly on the upper half of the tree, and *R. fausta* and *R. pomonella* on the lower. None has been found on the bark or twigs. Where apple and cherry trees are interplanted, *R. fausta* has been confined to cherry and *R. pomonella* to apple. The flies take short, rapid flights when disturbed and are hard to catch, except in extremely warm, damp weather.

Observations are described on the oviposition of *R. fausta* [*R.A.E.*, A, xx, 691]. Control is rendered difficult by the numbers of *R. fausta* and *R. cingulata* breeding in *Prunus serotina*, *P. virginiana*, *P. pennsylvanica* and *P. mahaleb* [*cf.* xx, 464 ; xxi, 338], and of *R. pomonella* in *Crataegus*.

Morofsky (W. F.). **Distribution of May-beetles (*Phyllophaga*) in Michigan.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 831–834, 1 ref. Geneva, N.Y., August 1933.

A list is given of 16 species of *Lachnosterna* (*Phyllophaga*) occurring in Michigan, with notes on the distribution of the 7 that are most numerous. *L.* (*P.*) *rugosa*, Melsh., which is the most abundant species in the State and is distributed over the south-eastern third of it, attacks poplars and elms, and *L.* (*P.*) *hirticula*, Knoch, found in the south-west, defoliated oaks in 1930–32. Of 10,000 adults of all species taken at electric lights, 89 per cent. were found to be males, except in the case of *L.* (*P.*) *anxia*, Lec., the most widely distributed, of which 75 per cent. were females.

McDaniel (E. I.). **Spraying to control the Gladiolus Thrips, *Taeniothrips gladioli* M. & S., in Michigan in the Season of 1932.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 835–836. Geneva, N.Y., August 1933.

In 1932, infestation of gladiolus by *Taeniothrips gladioli*, Moult. & Stnw., in Michigan was local rather than general, losses being most apparent where new assortments of corms had been obtained from several sources or where the corms had been stored at high temperatures. Of the sprays tested, those containing lead arsenate and glue were the most effective, the percentage of uninfested plants being as high as 95. A preferred formula is given [*R.A.E.*, A, xxi, 256]. Nicotine sprays [*cf.* xxi, 466], which were used by growers, often proved ineffective owing to excessive dilution, or failure to apply immediately after mixing. Heavy watering in dry weather and the use of a fertiliser containing powdered naphthalene gave promising results.

Bailey (S. F.). **A Contribution to the Knowledge of the Western Flower Thrips *Frankliniella californica* (Moulton).**—*J. Econ. Ent.*, xxvi, no. 4, pp. 836–840, 10 refs. Geneva, N.Y., August 1933.

Frankliniella californica, Moult., the distribution of which in western North America is discussed, has been collected from practically all wild flowers and fruit blossoms throughout the area over which it occurs. It is seldom seen on the exposed surfaces of its food-plants, though the adults may take short migratory flights. In California, it has been collected from sea-level up to 4,000 ft. and is believed to occur at much higher levels. The chief economic damage caused by this thrips is "silver spotting" on young fruits [*R.A.E.*, A, xx, 31], particularly peaches, apricots, oranges and apples. The feeding of both adults and larvae upon parts of the flowers and tender unfolding buds of plants, both commercial and ornamental, affects the set of fruit and causes malformation and stunting. Injury has also been caused to lucerne and to figs [xvii, 358 ; xx, 357].

In California the winter is passed chiefly in the adult stage, and as the males are apparently shorter lived and less resistant to weather conditions, there is a preponderance of females in winter and early spring. The peak of infestation in native food-plants occurs in late spring. The population drops sharply as the food-plants dry up or become tough and remains small until after the first autumn rains, when a gradual increase occurs. Full-grown larvae and a majority of adults (especially females) survived exposure to 32°F. for 5 days. Adult activity was greatest about 80°F. In the laboratory, the adults sometimes lived 44 days, with an average of 20 ; under field conditions,

they live about 3 weeks or (during the winter) 3–4 months. The incubation period varies from 5 days at 80°F. to about 15 days out of doors in early spring. The larval stage lasts 9–12 days under favourable field conditions, larvae found during December, January and February requiring possibly as long as 2 months. The pre-pupal stage lasts 1–3 days and the pupal stage from 3 days (at 90°F) to 10. In the laboratory, unmated females produced offspring, which appeared quite normal, but was not reared to maturity. Mating continues intermittently throughout the life of both sexes. Unlike *Hercothrips fasciatus*, Perg., which will not mate until fed, *F. californica* mates immediately after emerging and often before feeding.

Crops are exposed to infestation by migrating thrips at the time when the wild food-plants dry up. In late summer and early autumn, the adults migrate back to the native food-plants. When cover crops are ploughed under or lucerne fields are mown, adjacent crops and ornamentals often become very seriously infested. The eggs are deposited in the tenderest portions of the plant tissues. The larvae which begin to feed immediately upon hatching and have only been observed to moult once, feed gregariously together with the adults. When full-grown, they drop to the ground, where the prepupal and pupal stages are passed. Pupae may be found from the surface (among débris) to 3–4 inches below (in crevices or under clods).

DRAKE (C. J.), TATE (H. D.) & HARRIS (H. M.). **The Relationship of Aphids to the Transmission of Yellow Dwarf of Onions.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 841–846, 7 refs. Geneva, N.Y., August 1933.

Much of the information given in this paper on yellow dwarf of onions and its Aphid vectors has already been noticed [*R.A.E.*, A, xx, 706]. Recent work in Iowa has added many species taken on onions or neighbouring plants to the list of experimental vectors, over 50 of which are enumerated. Most Aphids feed rather readily on onion in the absence of the customary food-plant. Apterous viviparae of some of the more active species, such as *Acyrthosiphon onobrychidis*, Boy. (*Macrosiphum pisi*, Kalt.), individuals of which have been observed to feed on 4 different onion plants in 30 minutes, were frequently found on onions as far as 100 ft. from any plants of other species.

The first Aphid observed on onions in Iowa in 1932 was *A. onobrychidis* on 10th May, and three days later this species was found in fields bordering lucerne at the rate of 2,500 to an acre. Later in the month, *Aphis rumicis*, L., became as common and as generally distributed, *Aphis helianthi*, Monell, and *Hyalopterus atriplicis*, L., being also present, together with several other species. During the latter part of July, both in 1931 and 1932, *A. gossypi*, Glover, was the commonest species in many onion fields, whereas records for many seasons show that *Rhopalosiphum prunifoliae*, Fitch, was by far the dominant species after the onion crop is harvested, and was largely responsible for the spread of the disease among self-sown onions in autumn.

EYER (J. R.) & CRAWFORD (R. F.). **Observations on the Feeding Habits of the Potato Psyllid (*Paratrioza cockerelli* Sulc) and the Pathological History of the " Psyllid Yellows " which it produces.** —*J. Econ. Ent.*, xxvi, no. 4, pp. 846–850, 3 pls., 8 refs. Geneva, N.Y., August 1933.

Investigations carried on during the past 3 years in New Mexico on the insects affecting the production of Irish potatoes in that State have

shown that *Paratrioza cockerelli*, Sulc, with the associated "yellows disease" [*cf. R.A.E.*, A, xxi, 454], is one of the most important. It is not easily controlled by the insecticides ordinarily employed against sucking insects. As the exact nature of the causal agent has not been demonstrated, experiments were conducted to determine whether any direct relation could be found between the external symptoms of the disease and the feeding of the nymphs on the plant tissues. Nymphs reared from eggs on healthy potato plants failed to produce the disease.

The following is taken from the authors' abstract and conclusions: Studies of histological sections of *P. cockerelli* in feeding position on potato foliage show the setal sheath penetrating the mesophyll into the border parenchyma immediately surrounding the vascular bundles [*cf.* xi, 250]. Most of the feeding seems to occur in this region. It may be concluded from the results so far obtained that the nature of the feeding of *P. cockerelli* is not such as would induce symptoms of "Psyllid yellows" by wholesale destruction or mechanical plugging of the vascular tissues. There is probably an inhibition of translocation [*cf.* xix, 688], complicated by disturbances of the photosynthetic activities of the plant. The region of extensive feeding is so situated that primary disturbances could be readily complicated by the injection of some infectious principle or disturbing enzyme.

EBELING (W.). **Variation in the Population Density of the California Red Scale,** *Aonidiella aurantii* **Mask., in a hilly Lemon Grove.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 851–854, 2 figs., 3 refs. Geneva, N.Y., August 1933.

Field experiments over a number of years in certain hilly sections of southern California have suggested that *Citrus* in the higher districts is more heavily infested with *Chrysomphalus* (*Aonidiella*) *aurantii*, Mask., and that trees in the higher portions of a grove usually carry the most severe infestation. It has also been commonly observed that *C. aurantii* is more readily controlled in the lower parts of the groves. More exact data obtained in a typical hilly lemon grove, the altitudes in which varied by about 40 ft., showed that, with some exceptions, the scale population increased markedly with altitude. The average temperature (April–May) was 4·73°F. higher at the highest than at the lowest portions of the grove, the greatest variation occurring at night. In the early afternoon the temperature was in a few cases higher at the lower elevation. It is concluded that the variation in density of *C. aurantii* in this grove is due to temperature, although altitude may not be the sole factor affecting the temperature of the immediate environment of the scale. The comparatively shallow and impoverished soil on the hill-tops produces smaller trees growing in more open situations, thus admitting more sunlight and providing a warmer environment for the insects on them. On the other hand, the data from one part of the grove suggest that impoverished soil may produce trees in such a weakened condition that they have ceased to be suitable food-plants for the scale, which will thus be present on them in smaller numbers. Temperature records from another grove in the district show a difference of 6–10°F., depending upon humidity, between the lowest and highest portions during fumigation of the trees.

Although the greater resistance to control measures of particular strains of *C. aurantii* has been demonstrated [*R.A.E.*, A, xi, 80, etc.],

it is not known to what extent the apparent greater resistance of the scale found in the warmer foothill districts may be attibuted to differences in temperature, or how far it is due to the fact that lemon, which is the species of *Citrus* most commonly planted in them owing to its lack of resistance to frost, is the preferred food-plant of the scale.

COLE (F. R.). **Natural Control of the Citrus Mealybug.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 855–864, 1 fig., 23 refs. Geneva, N.Y., August 1933.

A brief history is given of *Pseudococcus citri*, Risso, in California, where it is now very scarce, apparently owing to the activities of natural enemies. Notes are given on the predators and parasites present during the early outbreaks and continuing through to 1918 [*cf. R.A.E.*, A, viii, 318 ; ix, 190 ; etc.]. The most important of these are shown in a chart, in which their inter-relations are indicated. *Cryptolaemus montrouzieri*, Muls., and *Tanaomastix* (*Leptomastidea*) *abnormis*, Gir., are credited with the major part of the reduction in the numbers of the mealybug. The Encyrtid, *Chrysoplatycerus splendens*, How., is the only actually specific enemy, although *L. abnormis* and to a less extent the Neuropterous predators, *Sympherobius californicus*, Banks, and *S. barberi*, Banks, are nearly so. The existence of alternative sources of food, though it means that the insect enemies of *P. citri* are not concentrated in their attack, serves to keep them alive when the mealybug is scarce.

ESSIG (E. O.). **Farm Machinery in Relation to Insect Pest Control.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 864–868. Geneva, N.Y., August 1933.

The following is the author's abstract : Regular farm equipment used in ploughing, planting, cultivating and harvesting, and special machinery employed in irrigating, levelling and many other farming practices may contribute considerably to the reduction and even to the control of certain insect pests that may be present on the plants, in the stems or stubble, in the seeds or tubers, and in the soil. Many attachments may also be used on such machinery for the express purpose of destroying insects.

ESSIG (E. O.). **Insects and Agriculture.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 869–872. Geneva, N.Y., August 1933.

The effect of modern methods of crop selection and crop specialisation upon insect pests is discussed. Artificial conditions often prove more suitable for their development than their natural environment, and the creation of great areas of single crops has in many cases constituted an important factor in the rise of present economic entomology. Insects have undoubtedly increased both in abundance and destructiveness during the past century. Their attacks are more constant, and the higher standards now required for the marketing of fruit and vegetables make commercial control progressively more difficult and expensive. As insect pests cannot reduce quantity without lowering quality, it is necessary, in order to have food products of good quality, to maintain a high level of control.

BARRETT (R. E.). **A general Method for Measuring Insect Populations and its Application in Evaluating Results of Codling Moth Control.** —*J. Econ. Ent.*, xxvi, no. 4, pp. 873–879. Geneva, N.Y., August 1933.

A detailed account is given of a method of determining field populations and changes in population of the codling moth [*Cydia pomonella*, L.] infesting walnuts in California. The same method could be applied, with slight modifications, to many different types of work. The percentage of larval injury for an orchard is obtained by counting the infested nuts in 100 taken at random from each load delivered to the packing houses, and the number of infested nuts by multiplying the crop produced (taking 1 lb. as 41 nuts) by the fraction represented by this percentage. As not more than one larva is found in a nut in California, this will give the population in the orchard. A formula for calculating the probable error is given.

Figures are presented indicating changes in populations resulting from work in the control of *C. pomonella* on walnut carried out in California over a period of 5 years.

NEWCOMER (E. J.) & CARTER (R. H.). **Casein Ammonia, a practical emulsifying Agent for the Preparation of Oil Emulsions by Orchardists.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 880–887, 6 refs. Geneva, N.Y., August 1933.

A method is given for the preparation of insecticidal oil emulsions in which casein-ammonia is used as the emulsifying agent. Laboratory and large-scale tests that confirm the satisfactory qualities of these home-made emulsions are described. Experiments and practical experience of fruit-growers in the north-western United States, using oils for summer or dormant spraying, has shown the following proportions to be the most satisfactory : 100 U.S. gals. oil, 33 U.S. gals. water, 3 lb. finely powdered casein and 1 U.S. qt. 28 per cent. ammonia. Examples are given of methods for mixing with 600-gallon portable and 1,000-gallon stationary spray outfits respectively, from which it is seen that the operation may be continuous. The agitator should be running when the ammonia is put into the water, and the casein should be sifted slowly in to avoid lumps. It mixes with the ammoniated water immediately, and it is not necessary for the mixture to stand. The oil, which may be either pumped or poured in direct from the drums, should not be added too rapidly. If the emulsion has been thoroughly mixed by means of the agitator, there appears to be no need to pump it more than once, and it may be simply pumped out through the overflow of the tank. The emulsions thus made have been kept for 6 weeks without deterioration. Smaller lots of a few quarts or gallons may be successfully produced by stirring with an electric mixer or pumping with a bucket pump. The method only fails when a water-in-oil emulsion is produced [*cf. R.A.E.*, A, xvi, 423] ; this occurs when there is more than about 85 per cent. oil in the mixture, and such an emulsion cannot be reversed even though the proper quantity of water is added later. An oil-in-water emulsion, on the other hand, may be reversed simply by adding oil while it is being stirred. Reversed emulsions apparently result from trying to make too small a quantity in a large tank. The free oil may be drawn off from a reversed emulsion after it has been allowed to stand for a time, or the latter may be used in the same way as oil to make fresh emulsion, due allowance being

made for the lower percentage of oil in it. Experiments with various emulsifiers demonstrated the superiority of casein-ammonia, and the emulsions prepared with it cost very much less than commercially prepared ones. Although the diameter of the oil droplets in the home-made emulsions averaged 12 μ, as compared with 4 μ in the commercial ones, it has been shown that this difference has no effect on their toxicity to San José scale [*Aspidiotus perniciosus*, Comst.] or to the eggs of the codling moth [*Cydia pomonella*, L.]. The smaller droplets are only necessary in an emulsion that is to be shipped and kept for several months. The home-made emulsions were not more liable to injure fruit-trees than the commercial ones, and they left about the same quantity of oil deposit on apples. The amount of lead arsenate deposited on 1 lb. of apples by a spray containing 1 lb. to 50 U.S. gals. was 0·072 gr. when the spray included 0·75 per cent. oil in a home-made emulsion, and 0·071 gr. when it included a commercial emulsion at the same rate, as compared with 0·068 gr. when no oil was used.

JONES (E. W.). **The Influence of Temperature on the Toxicity of Carbon Disulphide to Wireworms.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 887–892, 2 figs., 8 refs. Geneva, N.Y., August 1933.

A study is described of the toxicity of carbon bisulphide to wireworms (*Limonius* sp.) at various temperatures, when other factors such as diffusion and adsorption have been eliminated. The wireworms were exposed to the fumigant for 5 hours in glass vials without soil, under conditions of high relative humidity. The concentration in gm. per litre required to kill 50 per cent. within 5 days was 0·35 at 32°C. [89·6°F.], 0·057 at 22°C. [71·6°F.] and 0·1 at 12°C. [53·6°F.].

DIBBLE (C. R.). **Fumigation with Propylene Dichloride Mixture against** *Pyrausta nubilalis* **Hübn.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 893–895. Geneva, N.Y., August 1933.

In preliminary tests, fumigation in a tight metal container with a mixture of propylene dichloride and carbon tetrachloride (90 : 10) at the rate of 2 lb. to 100 cu. ft. of space gave a complete kill of larvae of *Pyrausta nubilalis*, Hb., naturally established in maize stalks. The stalks were cut into sections a foot long. The shortest exposure giving complete control was one of 24 hours at 60–78°F., although many borers were killed by an 18-hour exposure. The results obtained suggest the possibility of developing a method of fumigation for vegetable produce before movement from infested areas.

JONES (R. M.). **A precise Method for Determining the Toxicity of mixed Gases to Insects.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 895–902, 1 fig., 29 refs. Geneva, N.Y., August 1933.

The following is almost entirely the author's abstract : The principle underlying this method for the determination of the toxicity of mixtures of carbon dioxide and other gases to insects is the introduction of the vapours into a partially evacuated fumigation flask, the amounts being measured by means of a mercury manometer, the fall of which is proportional to the concentration of the gases. Air is then allowed to flow until the mixture is reduced to atmospheric pressure. The details

of the method are given, and the apparatus is figured. The literature on methods for the determination of the toxicity of fumigants to insects is briefly discussed.

Fumigants with boiling-points above 60–70°C. should be measured into the flasks in liquid form, after the desired amount of carbon dioxide has been admitted. Tests on *Tribolium confusum*, Duv., with several low-boiling compounds showed that the toxicity of a particular concentration remained the same whether it was admitted in liquid or vapour form.

STEAR (J. R.). **Investigation of Naphthalene as a Fumigant against the Peach Tree Borer,** *Aegeria exitiosa* **Say and Sod Insects, a Progress Report.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 903–906, 2 refs. Geneva, N.Y., August 1933.

The results obtained in Pennsylvania during one year's tests of the possibility of using crude or refined naphthalene in the control of *Aegeria exitiosa*, Say, are recorded. To test the effect on peach of "mound" applications, the fumigant was placed at or near the base of the trunk at the rate of ½ oz. per tree and covered with earth [*cf.* *R.A.E.*, A, xvi, 455, etc.] When placed in contact with the bark, it caused gumming and dead areas, the injury being slight after 2 weeks' exposure but considerable after 4–8 weeks. When applied in a ring 1–2 inches from the tree, it caused no injury after 8 weeks exposure and only slight injury after 11 months. Under all conditions, the crude naphthalene appeared to be more injurious than the refined. No larvae were present in the trees when these tests were made, but previous workers have found that naphthalene is not volatile enough under the conditions of use against them to be effective with mound treatments. In a test carried out to determine whether larvae of the borer could be prevented from entering the trees by placing naphthalene around the base at the beginning of oviposition without mounding it over, cards bearing about 20 eggs were pinned in late August to a number of trees, round most of which ½–2 oz. naphthalene had been heaped 2 weeks earlier. Although 98 per cent. of the eggs hatched, no larvae could be found in the following March in the treated trees, though some were present in each of the controls. All treatments, however, injured the trees at and below the level of application. As the price of naphthalene is less than one-third that of paradichlorobenzene and surface applications would greatly reduce the cost of labour, further investigation appears to be warranted.

In preliminary tests carried out in 1932 to determine whether naphthalene would be effective against pests in lawns and golf greens, plots 4 ft. square were treated by broadcasting refined chip naphthalene at the rate of 200, 400 and 600 lb. to the acre. In some cases it was then brushed in or watered, but no difference could be observed in the results obtained. Observations 72 hours and 30 days after treatment showed temporary scorching of dandelion and destruction of white clover without injury to the grass. Shell vials containing wireworms and cutworms, closed with cheesecloth, were laid on the ground in each plot on the day following the application of naphthalene, at 11 a.m. with an air temperature of 80°F. and 81°F. at the base of the grass. On examination 3 hours later, all the larvae were dead in the 600 lb. plots and 66 per cent. in the 200 lb. plots.

Hills (O. A.). **A new Method for Collecting Samples of Insect Populations.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 906–910, 1 pl., 1 fig. Geneva, N.Y., August 1933.

A detailed description is given of a new apparatus for determining insect populations on plants. Two circular bands of strap iron, each 13·56 inches in diameter (enclosing 1 sq. ft.), are connected by four 20-inch uprights so as to form the framework of a stout cylindrical cage. The edge of the lower band is sharpened so that it will sink easily into the soil, and a 4½ ft. pitchfork handle is fastened to it horizontally so that the cage can be suddenly set in place over a plant. The sides are of stout sheeting, and the top, which is made of canvas with a celluloid window, is fastened to a light metal hoop, the ends of which are drawn together with a thumbscrew so that it can be clamped round the upper band. In the side opposite to the handle is fitted a sleeve to permit the operator to insert his hand.

When the cage is in place, the insects may be readily collected with the aid of a vacuum apparatus. Two types are described. One, which is adequate when the insects are few and not very active, as in early spring and late autumn, is a modified pipette, for which the suction is provided by the operator's lungs ; the other, for use during the warmer months, is worked by electricity, the suction being supplied by a small motor-driven fan.

Smith (C. E.). **An unreported Habit of the Seed Corn Maggot,** *Hylemyia cilicrura* **Rond.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 910–911. Geneva, N.Y., August 1933.

Phorbia (*Hylemyia*) *cilicrura*, Rond., which has not previously been recorded as attacking parts of its food-plants above the ground, was observed by the author in Texas damaging the immature unfolding leaves of spinach at the apex of the plant above the crown. Although the plants are not completely destroyed, they are so deformed as to be unfit for shipment. Plants having a compact terminal growth are most subject to attack. According to reports of growers in the locality concerned, the crop is often severely damaged but injury occurs only in wet weather, when the plants are also affected by mildew, which may be a factor in causing the fly to depart from its normal habit of ovipositing in the soil and breeding on subterranean matter. A similar type of damage to spinach has been reported from Washington, where it was more severe in fields that had received heavy applications of farmyard manure before planting, but did not appear to be associated with mildew.

McGovran (E. R.). **A Spray for Insect Control in empty Grain Bins.**—*J. Econ. Ent.*, xxvi, no. 4, p. 911. Geneva, N.Y., August 1933.

The recent necessity for holding grain in storage for long periods in unusually large quantities in Illinois has resulted in a marked increase in stored grain insects. Good results in their control have been obtained by the application to empty grain bins of a spray consisting of 8 U.S. gals. miscible oil, of the type used on dormant trees against Coccids, and 3 lb. lye to 100 U.S. gals. water. The spray should be applied to the walls and floor and wet all waste grain, chaff and dust that has not been removed from the crevices. It is also effective against

adult beetles, which are difficult to wet and kill except with unemulsified oils. Although it softens paint if allowed to lie on it in pools, it does not corrode metal if applied so that it dries in 3–4 hours; its caustic properties are rapidly neutralised by the carbon dioxide of the air and organic material such as chaff. The foundation of the bin and any chaff or waste grain under or near it should also be thoroughly wetted. The water in the spray may cause the grain to heat if applied to piles containing a bushel or more.

HIGH (M. M.). **A new Strawberry Pest.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 911–912. Geneva, N.Y., August 1933.

The Tenebrionid, *Crypticus obsoletus*, Say, is recorded as causing serious injury in a strawberry field in Missouri, where in February 1932, 90 per cent. of the fruit had been rendered unfit for consumption It was at first thought that the damage was due to *Agrotis ypsilon*, Hfn., and the mole cricket, *Scapteriscus aculeatus*, Rehn & Hebard, which were also present, but it continued unabated after these had all been controlled by a poisoned bait spread among the infested plants. The beetles were found feeding inside the ripe fruit, 5–12 or more being present on each plant. As soon as the plant was handled, they sought shelter among clods beneath it. They have since been found injuring strawberries in several fields.

AULL (L. E.) & DEAN (R. W.). **Efficiency of Lubricating and Tar Oil Emulsions against Scurfy Scale** (*Chionaspis furfura* **Fitch**).—*J. Econ. Ent.*, xxvi, no. 4, pp. 912–913. Geneva, N.Y., August 1933.

In tests conducted in the Hudson Valley with dormant sprays for the control of *Chionaspis furfura*, Fitch, on fruit trees, the percentages of the egg-masses killed by lubricating oil emulsified with Bordeaux mixture were 93·31 at 6 per cent. strength, 85·64 at 5 per cent. and 89·84 at 4 per cent. in 1932, and 71·4 at 4 per cent. and 47·33 at 3 per cent. in 1933. In the latter year, the percentages killed by a proprietary tar distillate wash [*cf.* *R.A.E.*, A, xx, 521] were 96·55 at 6 per cent. strength, 72·6 at 4 per cent., and 69·43 at 2 per cent. Natural mortalities on control trees in these years were 1·5 and 1·11 per cent. of the egg-masses. Hatching was complete by the end of May in both years. The number of eggs under each mass varied from 7 to 83 with an average of 40, and normally 98 per cent. of the eggs hatched. No noticeable injury was caused to the trees by the tar distillate, but bud development was delayed and a few buds killed by the 5 and 6 per cent. oil emulsions, though the trees soon recovered.

SHEPARD (H. H.) & CARTER (R. H.). **The Relative Toxicity of some Fluorine Compounds as Stomach Insecticides.**—*J. Econ. Ent.*, xxvi, no. 4, p. 913. Geneva, N.Y., August 1933.

The relative toxicity to silkworms [*Bombyx mori*, L.] of a number of fluorine compounds was determined roughly by the senior author by means of the sandwich method [*R.A.E.*, A, xviii, 311]. The solubilities in water of the compounds tested were determined by the junior author [*cf.* xvii, 87; xix, 307]. The results were as follows, the figure in brackets after each compound being its solubility at 25°C. (expressed as grammes per 100 cc.) and the others showing (as mg. per gm. of body

weight) the range within which the median lethal dose lay :—Fluorides : sodium (4·054) 0·11–0·15 ; manganese (0·186) 0·2–0·4 ; lead (0·066) 0·25–0·4 ; magnesium (0·013) $>$ 0·57. Fluosilicates : sodium (0·762) 0·1–0·13 ; potassium (0·177) 0·07–0·1 ; barium (0·025) 0·09–0·12. Fluoaluminates : sodium (0·061) 0·05–0·07 ; potassium (0·158) 0·08–0·1 ; ammonium (1·031) 0·11–0·14. Solubility was not directly related to toxicity except among the four fluorides. The senior author also tested the fluoaluminates of strontium, zinc, barium, magnesium and calcium, finding them less toxic than those mentioned above. Their toxicity decreased in the order in which they are named.

HOWARD (N. F.) & FLETCHER (F. W.). **The Effects of various Commercial Calcium Arsenates on Bean Foliage.**—*J. Econ. Ent.*, xxvi, no. 4, p. 914. Geneva, N.Y., August 1933.

A report by the authors dealing with the results of investigations in Ohio during 1929–31 on the effect on green beans of 19 commercial calcium arsenates has recently been issued in multigraph. Of the brands tested, 5 are rated as safe, 5 as intermediate and 9 as unsafe for use on bean foliage.

The following conclusions are drawn : In confirmation of previous experience, it has been demonstrated that hydrated lime is the most practical corrective for use with commercial calcium arsenate on bean foliage. A combination of 1 lb. sulphur and 4 lb. hydrated lime is an efficient corrective with 1 lb. calcium arsenate. Bordeaux mixture is an excellent corrective and is more effective than lime, but may itself cause plant injury under certain conditions if used alone, as may dusts of copper sulphate and lime, which are also good correctives. The rate of evaporation in the air, as measured by atmometer spheres, appears to be an important index of atmospheric conditions that influence the degree of injury to bean foliage caused by calcium arsenate. Quick drying of the spray tends to mitigate foliage injury. In many instances, it is difficult if not impossible to correlate the effects of humidity and temperature with the degree of foliage injury, nor is water-soluble arsenic, as present in most of the brands tested, an important index of it. Careful investigations in co-operation with chemists failed to devise a method of determining by chemical analysis the reason why some brands scorch and others do not.

The uniformity of the gross chemical composition and the toxicity to larvae and adults of the Mexican bean beetle [*Epilachna corrupta*, Muls.] tends to show that from certain standpoints commercial calcium arsenates are well standardised products, but the variability of their effect on bean foliage is very great.

SMITH (F. F.). **The Occurrence of** *Bregmatothrips iridis* **Watson in the United States.**—*J. Econ. Ent.*, xxvi, no. 4, p. 916. Geneva, N.Y., August 1933.

Bregmatothrips iridis, Watson [*cf. R.A.E.*, A, xii, 560], which has frequently been intercepted in the United States on iris imported from Holland, England and France, was found in October 1931 in the leaf axils of the common torch lily (*Tritoma uvaria*), and also in large numbers on Japanese iris [*Iris laevigata* (*kaempferi*)] in a nursery at Hamburg, New York. It has since been discovered on iris in several places in New York and one in Maryland. As iris plants have been

imported for many years, it is probably widely distributed in the United States.

Examination in April 1932 of the iris plants in which infestation had been first discovered showed only adult females to be present on the young shoots; as oviposition began as soon as they were placed in a warm temperature, it is concluded that fertilised females overwinter. In August 1932, the thrips were found only on iris, both sexes of wingless adults, larvae and pupae being abundant in the leaf axils. Although the foliage of the infested plants was severely stunted and discoloured, no injury to the flowers was noted, nor has any been recorded by growers. In view of the sheltered situations in which the thrips occur, spraying or dusting is not likely to be effective in controlling them. Digging the plants in late summer and immersing them in hot water for 15–20 minutes at a temperature of 120°F. might be effectual, and this treatment has been provisionally adopted for imported iris by the Bureau of Plant Quarantine.

Howard (B. J.). **The Influence of Insects in the Souring of Figs.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 917–918, 1 ref. Geneva, N.Y., August 1933.

In the summer of 1928 in California, figs protected from infestation by insects were much less soured [*cf. R.A.E.*, A, xvi, 320] than unprotected ones on the same trees. There was no significant difference between those protected by cloth bags and those in which the ostiole had been smeared with an adhesive (tree tanglefoot), but the effect of protection was most marked when it had been applied before the scales round the ostiole were beginning to open. All figs were examined after they had ripened and dropped.

Howard (L. O.). **Fighting the Insects. The Story of an Entomologist.**—Demy 8vo, xvii+333 pp. New York & London, The MacMillan Company, 1933. Price 12*s*. 6*d*.

This interesting autobiography, although by no means devoted wholly to entomological subjects, throws much light on the evolution of economic entomology in the United States during the last fifty years.

Glendenning (R.). **A successful Parasite Introduction into British Columbia.**—*Canad. Ent.*, lxv, no. 8, pp. 169–171. Orillia, August 1933.

In April 1931, an attempt was made to extend the area in British Columbia in which *Blastothrix sericea*, Dalm., was established as a parasite of *Lecanium* (*Eulecanium*) *coryli*, L., following the liberation of two consignments sent from England by the Imperial Institute of Entomology in 1928 [*cf. R.A.E.*, A, xx, 67]. Bundles of heavily infested twigs from the colonised area, collected one week before the parasites were due to emerge, were placed in crotches of trees at nine sites, some as much as 14 miles apart, over the area of scale infestation round Vancouver City. In autumn, the Encyrtid was found to be fairly evenly distributed over the whole area (about 150 sq. miles), causing a parasitism ranging from 10 to 80 per cent., and in the spring of 1932, it was found possible to omit the usual oil sprays against the scale on shade trees [*cf.* xiv, 174]. In North Vancouver, where the first liberations were made (in 1928), the number of scales per foot of twig on

sample trees averaged 35 in 1930 and 24 in 1931 ; in 1932, the greatest number found was 2, with a parasitism of 90–100 per cent. The parasite is not known to have any other host.

MONTGOMERY (B. E.). **Preliminary Studies of Insect Parasites in Indiana.**—*Canad. Ent.*, lxv, no. 8, pp. 185–190, 1 ref. Orillia, August 1933.

Parasites reared from Lepidoptera in Indiana, chiefly in 1931, include the following : *Spilochalcis mariae*, Riley, and the Ichneumonid, *Eremotylus macrurus*, L., from the Saturniid, *Telea polyphemus*, Cram. ; the Braconids, *Rhogas terminalis*, Cress., *Apanteles xylinus*, Say, and *Microplitis feltiae*, Mues. [*R.A.E.*, A, x, 551], and the Tachinids, *Winthemia rufopicta*, Big., *Archytas apicifera*, Wlk., and *Voria ruralis*, Fall., from the cutworm, *Lycophotia margaritosa* var. *saucia*, Hb. ; the Ichneumonids, *Astomaspis nanus*, Grav., from *Hemerocampa leucostigma*, S. & A., and *Pimpla* (*Itoplectis*) *conquisitor*, Say, and *Hemiteles* (*Allocota*) *thyridopterigis*, Riley, from *Thyridopteryx ephemeraeformis*, Haw. ; and *Glypta rufiscutellaris*, Cress., *Cremastus minor*, Cush., *Pristomerus ocellatus*, Cush., *Macrocentrus delicatus*, Cress., *Microbracon caulicola*, Gah., and *Microdus* (*Bassus*) *simillimus*, Cress., from *Epiblema strenuana*, Wlk. [*cf.* xix, 204]. The Miscogasterid, *Xenocrepis townsendi*, Ashm., the Pteromalid, *Pachyneuron allograptae*, Ashm., the Eulophid, *Cirrospiloideus johnsoni*, Gir., the Braconid, *Ascogaster carpocapsae*, Vier., a Bethylid, *Goniozus* sp., *Perilampus chrysopae*, Cwfd., *Helorus paradoxus*, Prov., and *Cremastus minor*, emerged in a room containing apples infested by *Cydia* (*Carpocapsa*) *pomonella*, L. ; some of them, however, may have been hyperparasites or parasites of other insects.

CLEARE (L. D.). **The White Grubs or " Hardback Beetles " injurious to Sugar-cane in British Guiana.**—*Ent. Bull. Dept. Agric. Brit. Guiana*, no. 2, ii+28 pp., 3 figs., 2 pls., 14 refs. Georgetown, July 1933.

Several Dynastids are becoming increasingly important as pests of sugar-cane in British Guiana, sometimes causing severe damage, though outbreaks do not last long or occur over very extensive areas. The larvae of *Dyscinetus geminatus*, F., attack the " tops " of seed pieces and the soft portions at the buds or root bands, and the adults of *D. bidentatus*, Burm., bore into large or small shoots at or slightly below the surface of the soil, so that fields infested by these species have sometimes to be replanted or even abandoned. The adults of *Ligyrus ebenus*, DeG., attack the larger shoots, but this species appears to occur on sugar-cane only in the north-east of the Colony. *Cyclocephala signata*, F., has been occasionally reported from this crop, but it is thought to act mainly as a scavenger.

A combination of decaying vegetable matter, on which the larvae feed, and optimum conditions of moisture is essential for outbreaks. On the coast, these occur during the wet seasons (April-August and to a less extent November-January). The mean temperature of the earth at a depth of 1 ft. is about 82°F. [*cf. R.A.E.*, A, xx, 124]. Infestation by *D. bidentatus* occurs principally in ratoon fields that are already in poor condition [v, 148]. *D. geminatus*, however, most commonly attacks plant cane in fields in which flooding for several months has

resulted in the growth of vegetation, which on the removal of the water is cut down and, together with the remains of the old stubble, begins to decay. The conditions thus produced are most attractive to the ovipositing females.

L. ebenus [*cf.* xviii, 441] has only one brood a year, the egg-stage in the laboratory averaging 10·2 days, the larval 75·9 and the pupal 13, and the adults requiring several months in which to become sexually mature. There are usually two broods of *Dyscinetus* a year, the adults emerging at the beginning of the rains. Under favourable conditions, however, two generations may develop in a single wet season. The eggs of *D. geminatus*, which are laid in earthen cells a few inches below the soil, are found in May–September and January–March, the full-grown larvae in November–January and March–August. In the laboratory, the egg-stage averaged 7·5 days, the larval 49·2 and the pupal 9·4. The young larvae feed on the decaying vegetation in the soil, and it is usually the older ones that cause the greater part of the damage to cane, which is generally attacked after it has begun to decay. They may, however, continue to feed on the vegetable material, pulverising the soil and thus improving its general tilth. The adults, which occasionally tunnel into the young growing shoots but are less injurious than those of *D. bidentatus*, are readily attracted to lights, which may be employed in their control when flight first begins. This method, however, is not effective against *D. bidentatus*, which is the most destructive species. The eggs are laid singly in the soil during about April–July and November–February and hatch in 8–14 days. The larval period occupies about 2 months, full-grown larvae being found about June–October and December–April. The pupal stage lasts about 2 weeks. The first brood is the more important and reaches its maximum abundance in May–June. All stages of these three species are described.

Natural enemies include various birds, *Solenopsis geminata*, F., which attacks the larvae in exposed positions, the larvae of Asilids, which are predacious on them, and *Bufo marinus* [*cf.* xxi, 235], which feeds readily on the adults. In the laboratory, mites and thread-worms destroyed many eggs and newly-hatched larvae. *Tiphia parallela*, Smith, is probably the chief enemy attacking *Dyscinetus*. The adults feed on the honeydew secretion of Aphids and Coccids, and the females burrow into the soil and oviposit on the larvae, which they first sting and temporarily paralyse. The parasite larva remains attached to that of the host, feeding on its body fluids and finally on the actual tissues. The pupal period is passed in a tough elongate-ovate cell within a loose, fluffy covering. Another Scoliid, *Campsomeris* (*Dielis*) *dorsata*, F., has been recorded from the larvae of *L. ebenus*, but it appears to be rare. The fungus, *Metarrhizium anisopliae*, is of common occurrence and under favourable conditions may cause a high mortality of the larvae. The grubs, particularly the young ones, are very susceptible to abnormal conditions of rainfall, an excess probably being more unfavourable than a deficit.

Outbreaks of *D. bidentatus* may be largely prevented by replanting affected areas as soon as possible and by improving the drainage and other conditions of the soil, where they are found to be a contributing factor. Harvesting and planting should be timed so that the plants are not at a susceptible stage during the two periods when the adults are abundant. It is doubtful whether present economic conditions justify hand-collection of larvae and adults, and this measure is only

recommended against *D. bidentatus*, which is not affected by other control methods. *D. geminatus* is best controlled by re-flooding the fields for 18–24 or even 48 hours after infestation has first been observed, and the regular adoption of this practice (possibly for the shorter period) in plant fields that have been under water fallow is considered worthy of consideration. It is not recommended against *D. bidentatus*, however, as flooding even for short periods tends to accentuate the already poor condition of the soil, further weaken the stools and increase the amount of decaying vegetation.

SPOON (W.). **Waarnemingen over de samenstelling van *Derris*-wortel uit Ned. Oost-Indië in verband met zijne eventueele waarde als insecticide.** [Observations on the Composition of Derris Root from the Netherlands East Indies, in Connection with its Value as an Insecticide.] **Verdere waarnemingen over de samenstelling van *Derris*-wortel of akar toeba.** [Further Observations on the Composition of Derris Root or Akar toeba.]—*Ber. Afd. Handelsmus. K. Ver. kol. Inst.*, no. 63, 26 pp., 6 figs. (with a Summary in English); no. 67, 13 pp., 2 figs., 16 refs. Amsterdam, 1931 & 1932.

The first paper gives the results of an analysis of 12 samples of derris root from various parts of the Netherlands East Indies, the moisture content having been determined by drying at 100–102°C. and the active principles extracted with absolute ether for 15 hours, after which the ether was allowed to evaporate and the residue dried. The samples of *Derris malaccensis* [*cf. R.A.E.*, A, xxi, 573] all contained a high amount of toxic matter (including deguelin, tephrosin, toxicarol, resin, etc.) with a relatively low amount of rotenone; roots of 21–23 months yielded as much as 30 per cent. ether extract and only 3 per cent. rotenone. *D. elliptica* contained less total toxic matter (20 per cent.) but more rotenone (6 per cent.). Storage of the air-dried roots in a dry atmosphere for at least 3 years did not affect their quality. They could also be safely stored in the form of fine powder, provided that the moisture content remained as low as 7–8 per cent. The cost of export could be reduced by grinding before shipment.

The second paper deals with the cultivation of derris in the Netherlands East Indies, the keeping quality of the powdered root, which should always be packed in tins or tightly closed chests, and the results of further analysis. In 4 samples, 1 of *D. elliptica*, 1 of *D. malaccensis* and 2 commercial samples, the ether extract varied from 15·3 to 24·8 per cent. and the rotenone content from mere traces to 7 per cent.; *D. malaccensis*, with 21·5 per cent. of ether extract, contained only traces of rotenone.

SPOON (W.). **Rotenon-winning uit de surinaamsche nekòe-wortel, *Lonchocarpus* spec.** [Extraction of Rotenone from Surinam Nekòe Root, *Lonchocarpus* sp.]—*Ber. Afd. Handelsmus. K. Ver. kol. Inst.*, no. 65, 10 pp., 1 fig., 9 refs. Amsterdam, 1931.

According to Dr. A. Kleinhoonte, the species of *Lonchocarpus* from Dutch Guiana with which this paper deals is *L. chrysophyllus*. The moisture content of the root was determined by distillation with xylol. On an average, the root yielded 2·5 per cent. rotenone, and 9

per cent. total ether extract, including about 2 per cent. deguelin and small quantities of tephrosin. The stem is unimportant as a source of rotenone.

SPOON (W.) & ROWAAN (P. A.). **Grondstoffen voor het insecticide rotenon in Ned. Oost- en West-Indië.** [Raw Materials of the Insecticide Rotenone in the Netherlands East and West Indies.]—*Ber. Afd. Handelsmus. K. Ver. kol. Inst.*, no. 79, 17 pp., 2 figs., 22 refs. Amsterdam, 1933.

Brief notes are given on the world trade in *Derris* and *Lonchocarpus* roots, with the results of investigation of a number of commercial samples of the roots. The percentage of total ether extract obtained from *Derris* varied from 2·8 to 34·2 with an average of 18·9, while that of rotenone varied between 0 and 11·3, with an average of 3·2. *D. elliptica* appeared to contain most rotenone. The average percentages of total ether extract and rotenone were 8·8 and 2 from 3 samples of *L. chrysophyllus* from Dutch Guiana, and 12·7 and 3·7 from 4 of cubé root (*L. nicou*) from Peru.

SUIRE (J.). **Note sur les *Apanteles* parasites de la fausse-teigne des ruches,** *Galleria mellonella* **L.**—*Rev. Zool. agric.*, xxxii, nos. 3–4, pp. 45–51, 63–66, 1 fig., 14 refs. Bordeaux, 1933.

The parasites of *Galleria mellonella*, L., are discussed from the literature, and notes are given on original observations of the bionomics of *Apanteles hoplites*, Ratz., *A. lateralis*, Hal., and *A. galleriae*, Wlkn. [*cf. R.A.E.*, A, xx, 386], together with the characters distinguishing them. *A. hoplites*, which was found parasitising *G. mellonella* in a hive still containing live bees in the Department of Hérault, France, is not widely distributed. The egg is laid on the host larva at a late stage of its development, and the cocoon is found inside the cocoon or the dead body of the host, or even outside the gallery in which the latter had lived. This is one of the few species of *Apanteles* that also parasitises Coleoptera [*cf.* vi, 172; x, 230; xvi, 241]. *A. lateralis*, which occurs in England and Germany, was first recorded as parasitising larvae of *G. mellonella* in France in 1912 [xvi, 241]. The full-grown parasite larva emerges from the body of the host larva, which soon dies. The pupal stage, which is passed in a cocoon, lasts 8–10 days, and the adults, which mate immediately after emergence, have lived for over 2 months in the laboratory. This Braconid is negatively phototropic. It is reported to be of great value in reducing infestations of *G. mellonella*.

A. galleriae was found in great abundance in certain hives in the neighbourhood of Montpellier, parasitising equally *G. mellonella* and *Achroia grisella*, F., and parasitised in its turn by *Dibrachys cavus*, Wlk. (*boucheanus*, Ratz.), 2–3 of which were sometimes found in one host. Adults of the Braconid emerged in May and again in August; some also emerged in October–November, others of this generation overwintering. Oviposition occurs on host larvae of varying ages. At hive temperature, the pupal stage lasts about 15 days. Pairing, which occurs almost immediately after emergence, and oviposition are described. Adults were not attracted to host larvae deprived of the protection of their silken tube, whereas they were invariably attracted to empty galleries, in spite of their normal phototropism.

[Vukasović] Voukassovitch (P.). **Sur l'action des parasites et hyperparasites d'*Hyponomeuta malinellus* Zell.**—*Rev. Zool. agric.*, xxxii, nos. 2–4, pp. 29–43, 51–60, 67–76, 9 figs., 3 pp. refs. Bordeaux, 1933.

This study, which deals with the interrelations and activities of parasites and hyperparasites of *Hyponomeuta malinellus*, Zell., in Serbia, appears to cover the same ground as the third section of a paper already noticed [*R.A.E.*, A, xx, 259].

Peters (G.). **Blausäure zur Schädlingsbekämpfung.** [Hydrocyanic Acid Gas in Pest Control.]—*Samml. chem.-tech. Vortr.*, N.F. Heft 20, 75 pp., 21 figs., 189 refs. Stuttgart, F. Enke. Price, paper, *M.* 6·20.

In this book on the control of pests by means of hydrocyanic acid gas, separate chapters deal with the history and manufacture of this fumigant, its toxicity, its uses against pests, the various methods for producing the gas, and the prevention and treatment of poisoning in the operator.

Lr. **Ein neuer deutscher Speicherschädling: Der Samenzünsler. Starkes Auftreten des Kornkäfers und des Kabinettkäfers.** [A New German Store Pest. Outbreaks of *Calandra granaria* and *Anthrenus scrophulariae*.]—*Mitt. Ges. Vorratsschutz*, ix, no. 5, pp. 49–51. Berlin, September 1933.

Brief descriptions are given of the larva and adult of the Pyralid, *Aphomia gularis*, Zell., in view of its discovery in a cacao warehouse in Hamburg [*R.A.E.*, A, xxi, 176].

Attention is drawn to the great increase in Germany of *Calandra granaria*, L., in grain stored on farms, and of *Anthrenus scrophulariae*, L., feeding on woollens, carpets, and furs. The latter is favoured by the general adoption of central heating.

Herold (W.). **Ueber einige Wohnungsschädlinge** (*Glyciphagus*, *Lathridius*, *Ptinus*, *Tenebrio* **und** *Lariophagus*). [On some Pests of Dwellings.]—*Mitt. Ges. Vorratsschutz*, ix, no. 5, pp. 51–56, 2 figs. Berlin, September 1933.

In the summer of 1932, an outbreak of *Glyciphagus domesticus*, DeG., occurred in a house at Swinemunde, Pomerania, the focus of infestation being mouldy patches of wall-paper, which were also infested by *Lathridius bergrothi*, Reitt. Thorough drying of all the damp rooms [*cf. R.A.E.*, A, xiv, 584] and fumigation with Areginal proved successful against both the mite and the beetle.

In another house, the partitions and ceilings of papered canvas were heavily infested by *Ptinus fur*, L. Among the holes made by it were smaller ones bored by a Pteromalid, apparently *Lariophagus distinguendus*, Först., for which *P. fur* appears to be a new host. Some larvae of *Tenebrio molitor*, L., were also feeding on the pasted paper and mined into the wooden framing. The triple infestation was stopped by plastering the walls and ceilings, the few remaining Ptinids in beds, carpets and upholstered furniture being destroyed by fumigation.

REH (L.). **Witterung und Insekten.** [Weather and Insects.]—*Anz. Schädlingsk.*, ix, no. 9, pp. 109–112. Berlin, September 1933.

Discussing Friederich's paper [*R.A.E.*, A, xxi, 298], the author stresses the influence on insect populations of meteorological conditions causing variations in humidity, the importance of the temperature factor having been, in his opinion, overemphasised by recent workers. A number of observations are recorded from the neighbourhood of Hamburg, some confirming and others disagreeing with Friederich's findings in Mecklenburg. They were almost contrary as regards Aphids, to which dry weather or any check in the growth of the food-plants was unfavourable, whereas luxuriant growth, such as occurs after the application of certain manures, was favourable. Injury by Aphids is, of course, more evident in dry weather and on dry soil.

DECKERT (W.). **Hausbockbekämpfung und Hausbockzucht.** [The Control and Breeding of *Hylotrupes bajulus*.]—*Anz. Schädlingsk.*, ix, no. 9, pp. 112–114, 4 figs. Berlin, September 1933.

The infestation of houses by *Hylotrupes bajulus*, L., has increased in Germany, apparently owing to the use of unsuitable timber in post-war buildings. Fumigation with hydrocyanic acid gas, the application of hot air and the use of Xylamon as a wash or spray are the usual remedies [*R.A.E.*, A, xix, 379 ; xx, 456 ; xxi, 323, 324, etc.]. Other insecticide washes are available, but care is necessary to ascertain whether they afford protection if eggs are laid on the timber after treatment. A supply of eggs can be ensured by breeding. Females that had paired on 14th September oviposited 4 days later, and the larvae hatched out after 10–12 days.

STELLWAAG (F.). **Verbrennungen durch Schädlingsbekämpfungsmittel im Obstbau.** [Scorching by Insecticides in Orchards.]—*Anz. Schädlingsk.*, ix, no. 9, pp. 114–117, 4 figs. Berlin, September 1933.

In the author's experience, the scorching of fruit-trees by insecticides applied after blossoming is over is especially due to sudden changes in the weather. Such changes were common in 1933 in Germany, and instances of scorching by various sprays and dusts observed in that season are recorded.

[YAROSLAVTZEV (G. M.) & MOLCHANOVA (O. P.).] **Ярославцев (Г. М.) и Молчанова (О. П.). The Autumn Investigation on the Amount of the Sugar Beet Web Worm** (*Loxostege sticticalis*). [*In Russian*.]—*Plant Prot.*, 1932, no. 2, pp. 1–24, 2 maps, 6 refs. Leningrad, 1932. (With a Summary in English.) [Recd. September 1933.]

In 1931, an outbreak of *Loxostege sticticalis*, L., occurred in various parts of the Russian Union. It was not so serious as the outbreak of 1929, but much more so than that of 1930 [*R.A.E.*, A, xx, 262, 388, etc.]. In investigations over a wide area from the end of August till the beginning of October, the number of larvae hibernating in cocoons in the soil averaged from 41–167 per sq. yd. in areas lying to the east of the Volga and the Urals, particularly in northern and western Kazakstan and western and south-western Siberia. They were most abundant in virgin soils and in lands that had been long uncultivated. They

belonged to the second and third generations, having hatched in great numbers in the second half of August and in September as a result of the unusually wet weather, which also induced them to migrate from moist low-lying ground to the open steppe. In most districts all the third brood larvae entered hibernation ; only in the extreme south did some reach the adult stage.

In parts of Russia west of the Volga, the larvae averaged from 12 to 42 per sq. yd. and were again usually found in virgin soil and abandoned lands, except that in the Ukraine and northern Caucasus they were most numerous in loose cultivated soil. They belonged mainly to the third generation, which was less numerous than the second, and some of them pupated and produced adults (which were sterile), the percentage entering hibernation ranging from 1 to 70.

The investigations confirmed the belief that the presence of this Pyralid in cultivated land is accidental and confined to outbreak years. The vegetation of the infested areas was usually of the type that includes *Artemisia*, *Salsola kali*, *Atriplex*, *Polygonum aviculare*, and (in the deserts of Kazakstan) *Alhagi camelorum* and *Agriophyllum arenarium*.

From 1 to 17 per cent. of the cocoons contained Hymenopterous parasites, and 7–13 per cent. of the larvae had Tachinid eggs on them. The possible occurrence and severity of outbreaks in the various parts of the Russian Union in 1932 are briefly discussed.

[Zakharov (L. Z.).] **Захаров (Л. З.). The Problems of the Spring Survey of the infested Areas of Migratory Locust Egg-pods.** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 25–30. Leningrad, 1932. [Recd. September 1933.]

In reply to Zolotarev [*R.A.E.*, A, xx, 146], the author states that in addition to the autumn surveys of the egg-deposits of locusts [*Locusta migratoria*, L.] in the North Caucasus, spring surveys are required, in order to note the changes brought about by meteorological factors and parasites and to make more exact delimitations of the infested areas.

[Strachitzkiĭ (K. I.).] **Страчицкий (К. И.). On the Necessity of Addition of Lime in Suspensions of Paris Green for Orchard Spraying.** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 53–56, 1 ref. Leningrad, 1932. [Recd. September 1933.]

In view of Leibbrandt's conclusions [*R.A.E.*, A, xix, 243] that the addition of lime to arsenical sprays is liable to cause injury to the plants, tests were carried out in Moscow in which apple trees with young, healthy foliage were sprayed with Paris green at the rate of 2 or 4 lb. per 100 gals. water, with or without the addition of double the amount of lime. Paris green alone caused severe scorching of the foliage, whereas with the addition of lime it produced only partial and in most cases slight scorching.

Laboratory tests were also carried out to determine the solubility of Paris green in suspensions with or without the addition of lime, the water used being either distilled or saturated with carbonic acid. The suspensions were kept in open dishes or sealed flasks at 16–17°C. [60·8–62·6°F.] for periods varying from 24 to 50 hours, and the amounts in mgm. of arsenic that dissolved are shown in a table. These amounts were invariably much less in the presence of lime.

[VEBER (Ya. Kh.).] **Вебер (Я. Х.). A new Mass Pest of Oak Trees—*Coriscium brongniardellum* L.** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 57–68, 4 figs., 4 refs. Leningrad, 1932. [Recd. September 1933.]

For the last 20–25 years, the Tineid, *Acrocercops* (*Coriscium*) *brongniardella*, F., all stages of which are described, has been severely infesting an oak forest in the environs of Samara over an area of 35 sq. miles, trees growing near houses being much more heavily attacked than those at some distance. Observations carried out in 1925–31 showed that there are two complete generations a year, the adults of the second hibernating chiefly in uninhabited houses, sheds and attics, and only occasionally in cracks of the bark or under the forest litter. In buildings, the moths are found in great numbers on walls, window frames, etc., during September, October and part of November ; with the first severe frosts they drop to the ground and remain inactive till April. They abandon their winter quarters 3–4 days before the bursting of the oak buds, usually about the beginning of May. In some places as many as 170 hibernating moths have been found to a square foot of surface. In summer they rest by day on the lower surface of the leaves, and they are readily attracted by lights. The life-cycle of either generation from egg to adult is completed in about 40 days. Oviposition by the overwintered moths lasts about 13 days, being usually completed soon after 20th May. The eggs are laid singly on the upper surface of the leaves. In the insectary, the number deposited by a female varied from 82 to 223, and examination of random samples from the forest for four consecutive years showed the number on an infested leaf to average 8, with a maximum of 59, 90–95 per cent. of the foliage being infested. The larvae hatch in 4 days and mine in the leaves, eventually leaving only the upper and lower epidermis intact. If exposed, they die, being unable to enter a fresh leaf. After 18–25 days (about the middle of June), they eat exit holes in the leaves and drop to the ground on fine threads. During this period, the infested parts of the forest are densely covered with these threads, and it has been estimated that about 200,000 larvae occur on a tree 60–70 years old. Pupation takes place in a cocoon within a web of silk in the débris on the soil, in cracks in walls, or on leaves of bushes and grasses not more than 3 ft. from the ground. The pupal period usually lasts 12 or 13 days, though in very hot, dry weather it may be as long as 31. The adults emerge in late June or early July and oviposit exclusively on young leaves that develop from the dormant buds as a result of the shrivelling of the infested spring foliage. Though in the insectary the moths laid eggs on old leaves in the absence of young ones, all the larvae died three days after hatching. The larval stage lasts about 18 days, and the pupal 12–14, the adults of the second generation appearing about mid-August. The growth of the infested trees is greatly retarded and the yield of acorns is negligible.

During the period preceding pupation, the larvae are exposed to attack by a number of birds and by ants, wasps and the Carabid, *Calosoma inquisitor*, L. The only parasites reared from the cocoons were the Ichneumonids, *Pezomachus proximus*, Först., and *P. instabilis*, Först., the percentage of parasitism by the former varying from 0·9 to 7, and by the latter from 0·01 to 0·8. For control, the hibernating moths should be swept up and destroyed, and the fallen leaves and forest litter in which the pupae occur should be removed and burnt.

[ESTERBERG (L. K.)] **Естерберг (Л. К.). On two little known Insect Pests of Onion.** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 79–82, 1 fig. Leningrad, 1932. [Recd. September 1933.]

Investigations in the Government of Nizhniĭ-Novgorod during 1929–31 showed that *Acrolepia assectella*, Zell., is rare, though widely distributed, and that the severe infestation of onion generally attributed to this moth is actually due to the weevil, *Ceuthorrhynchus jacovlevi*, Schulze. The latter has not previously been recorded from Nizhniĭ-Novgorod, though it has been found on onion in other parts of the Russian Union [*R.A.E.*, A, xviii, 54, 96; xix, 80; xx, 150]. Notes are given on its bionomics [*cf.* xviii, 54]. The overwintered adults begin to appear at the end of April; they first attack the young leaves of onions that have been left in the field from the preceding year's harvest and then pass to the cultivated crop. The period of emergence from hibernation is very protracted, and pairing and oviposition continue till the end of June. The weevils do not fly far, so that onions planted at distances of 140–280 yds. from infested plots are not attacked. The larvae are active from about 10th May till about mid-June, the pupal stage lasts 7–8 days, and the young adults emerge in late June or early July. Heavy rain may kill the larvae, especially those at the base of the leaves. Crop rotation and other cultural measures are recommended for control, as well as the use of a trap crop of onions, which should be ploughed in at the end of May.

In 1931, onions in Nizhniĭ-Novgorod over an area of 250 acres were also attacked by *Gortyna* (*Hydroecia*) *micacea*, Esp. A list of the food-plants of this polyphagous Noctuid is given from the literature; the author does not know of any previous record of it on onion [but *cf.* *R.A.E.*, A, xviii, 97]. The larvae, which were first observed early in June, hollowed out the bulbs, 3–5 occurring in each. As the injured bulbs decayed, the larvae migrated to others. After about a month they pupated in the soil, and the adults began to emerge towards the end of July. The larvae were successfully controlled by the application of paradichlorobenzene, introduced into the soil at the rate of 0·5 gm. to each plant. It is possible that they attacked onions owing to their wild food-plants having been affected by the dry weather.

[SEMENOV (A. E.).] **Семенов (А. Е.). On the Control of** *Byturus tomentosus* **F.** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 83–84, 2 refs. Leningrad, 1932. [Recd. September 1933.]

Experiments carried out in 1925 near Leningrad have shown that the adults of *Byturus tomentosus*, F., which is the most important insect pest of raspberries in Russia, may be effectively controlled by means of a bee-keeper's smoker. The jet of smoke is directed on to the leaves, buds and flowers, so that the beetles fall into a tin funnel with a muslin bag at the end.

RIPLEY (L. B.) & HEPBURN (G. A.). **A new Method of marking Fruit Flies for Migration Studies.**—*Sci. Bull. Dept. Agric. S. Afr.*, no. 120, 5 pp. Pretoria, 1933.

In order to make extensive studies in South Africa on the migration of *Ceratitis* (*Pterandrus*) *rosa*, Ksh., the authors required a method of marking large numbers of the flies with different colours. The numbers to be handled rendered individual treatment impossible, and the use

of baits of fermenting wheaten pollard in water or terpinyl acetate in whale oil for trapping necessitated a mark that would remain visible on flies soaked for a few days in either bait.

During feeding experiments it had been noticed that, one or two days after milk was included in the diet of the fly, a soft pellet of milk curd, which tended to become harder as the milk ration was continued, was formed in the stomach. Experiments were then undertaken to test the possibility of colouring this pellet by staining the milk.

It was found necessary to feed the flies for three days on milk containing 5 per cent. honey, 0·5 per cent. dry yeast [*cf.* *R.A.E.*, A, xix, 342] and 0·1 or 0·2 per cent. stain, after which time water was substituted for the milk and the stain omitted. The milk pellet formed after 3 days' feeding remained for 2–3 weeks in the digestive tract, and the stain usually showed through the abdominal cuticle for a week or more and could subsequently be seen after dissection.

Of the four stains used, gentian violet, safranin and methyl green gave satisfactory results, whereas eosin was highly toxic. Gentian violet was slightly toxic at 0·2 per cent., and methyl green occasionally faded out entirely while a portion of the pellet remained in the stomach. The latter stain was, however, usually distinct for over twelve days. The disadvantage of safranin was that it resembled red fruit juice. The colours did not fade more rapidly when the honey solutions contained acetic acid. It was found that a milk diet prolonged the longevity of the flies, increased egg production and was conducive to pairing in captivity.

MAURITIUS. **Beneficial Insects (Protection) Ordinance, No. 36, of 1931.**—2 pp. Port Louis, Mauritius, 1931. [Recd. October 1933.]

This Ordinance provides for the protection of insects that may be declared to be beneficial in Mauritius and for the regulation of their capture, removal, possession, sale and distribution.

PHILIPPINE ISLANDS DEPARTMENT OF AGRICULTURE. **Bureau of Plant Industry. Administrative Order No. 12.**—6 pp. typescript, 1 ref. Manila, 8th May 1933.

This Order prohibits the importation into the Philippine Islands from countries infested with *Ceratitis capitata*, Wied., of 70 different fruits and vegetables, except in limited quantities under specified conditions.

LEVER (R. J. A. W.). **Notes on Two Hemipterous Pests of the Coconut in the British Solomon Islands.**—*Brit. Solomon Is. Prot. Agric. Gaz.*, i, no. 3, pp. 2–6, 2 pls. Tulagi, July 1933.

All stages of *Dasynus* sp. [*cf.* *R.A.E.*, A, xxi, 360] and *Axiagastus cambelli*, Dist., which attack coconut in the Solomon Islands, are briefly described. The nymphal period of the former averaged 33 days, and the whole life-cycle about 6 weeks. Much of the information on *A. cambelli* has already been noticed [xvii, 416], but during subsequent investigations, eggs have been found in large numbers on the remains of the fibrous stipule that grows along the edge of the leaf-base of coconut leaves, and in straight lines along the needle-like leaves of *Casuarina* sp., which, however, is probably not a food-plant. The incubation period averaged 7 days, and the life-cycle from egg to adult

$7\frac{1}{2}$ weeks. A dark meridional band appeared round the upper part of the eggs when they were parasitised by *Microphanurus* sp. [xxi, 207], and they became mottled when attacked by *Anastatus axiagasti*, Ferrière [xxi, 359].

LEVER (R. J. A. W.). **The Greater Spike Moth** (*Tirathaba rufivena*, **Walk.**) **and its Parasite** (*Apanteles tirathabae*, **Wilk.**).—*Brit. Solomon Is. Prot. Agric. Gaz.*, i, no. 3, pp. 7–8, 1 fig. Tulagi, July 1933.

Brief notes are given on the bionomics of *Tirathaba rufivena*, Wlk., in the Solomon Islands, and of its parasite, *Apanteles tirathabae*, Wlkn. [*cf. R.A.E.*, A, xxi, 482, etc.]. All stages of the moth are described. The numbers of the sexes are fairly equal. The Braconid lays one egg in each host larva, and the parasite larva emerges after 9–10 days and spins a cocoon, the adult appearing 6–7 days later. The males normally complete development in 15 days and the females in 17. The progeny of unfertilised females is male. Parasitism of larvae of *T. rufivena* reared from coconut on Guadalcanal in December 1932 was less than 1 per cent., and from *Nipa fruticans* $2\frac{1}{2}$ per cent. In contrast with its host, *A. tirathabae* is diurnal. Nine individuals of a hyperparasite, *Calliceras* sp., have been reared from a cocoon of this Braconid.

Xyleborus morstatti, **Haged., in Fiji.**

The Imperial Institute of Entomology has just received from the island of Taveuni, Fiji, specimens of the Scolytid, *Xyleborus morstatti*, Hag., which is reported as doing serious damage to avocado pear (*Persea gratissima*) by boring the twigs. This beetle, which was originally described from coffee in Tanganyika, has not previously been recorded from further east than the Netherlands Indies, where it has recently become a serious pest of coffee.

SIMMONDS (H. W.). **The Biological Control of the Weed** *Clidemia hirta*, **D. Don., in Fiji.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 345–348. London, September 1933.

Liothrips urichi, Karny, has continued to spread in Fiji [*cf. R.A.E.*, A, xviii, 616; xx, 380] and can definitely be said to have brought *Clidemia hirta* under control over large areas, not by directly killing it, but by so inhibiting its growth that it is no longer able to compete with dominant local plants. In Trinidad, *L. urichi* showed a marked aversion from shade, but in Fiji, probably owing to the much denser thrips population due to the absence of natural enemies, it has penetrated miles into the jungle, colonising heavily those clusters of the weed that received even a moderate amount of light.

EVANS (J. W.). **A simple Method of collecting Thrips and other Insects from Blossom.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 349–350, 1 fig. London, September 1933.

An apparatus is described that has been successfully used in collecting *Thrips imaginis*, Bagn., from blossoms of deciduous fruit-trees, etc., in Australia [*cf. R.A.E.*, A, xx, 601]. A bottomless glass cylinder (diameter, 5 ins.; height, 10 ins.) is fitted with a close-fitting lid, to the centre of which a cottonwool pad is attached inside by plasticine. The lid and all the cylinder except the bottom two inches are covered

with black paper. Two inches from the bottom, a removable perforated zinc plate rests inside the cylinder. When in use, the cylinder stands on a sheet of white paper, and the light of a bench lamp is directed on to the uncovered part. The pad is moistened with a few drops of turpentine, and an infested blossom is placed in the cylinder. The thrips are repelled by the turpentine, which also has a slow lethal action, and attracted towards the light. After 15–30 minutes, they are all found dead on the paper, except that if the blossom is wet, a certain number adhere to the cylinder. Larger insects are temporarily stupefied.

DAVIDSON (J.) & SWAN (D. C.). **A Method for obtaining Samples of the Population of Collembola (Symphypleona) in Pastures.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 351–352, 1 fig. London, September 1933.

As sweeping with a net failed to give reliable records of the population of *Smynthurus viridis*, L., and associated springtails in pastures in South Australia, an apparatus was devised consisting of a cylinder with handles, covered at the top with fine-mesh brass gauze and with the bottom bevelled to form a cutting edge. The cylinder is forced about ½ in. into the soil and then dug out with a spade, together with its contents, and closed at both ends with tight-fitting lids. It is then immersed in a vessel of water, and the lids removed, so that the soil drops out. The insects are skimmed from the surface of the water with a bell-mouthed cylinder closed at one end with fine muslin.

ANDREWARTHA (H. G.). **The Bionomics of *Otiorrhynchus cribricollis*, Gyll.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 373–384, 3 figs., 14 refs. London, September 1933.

Detailed studies are described on the bionomics of the weevil, *Otiorrhynchus cribricollis*, Gyll., in Western Australia [*cf. R.A.E.*, A, xix, 467]. In cells similar to those used by Searls [xvi, 556], the incubation period varied from 14 to 37 days, with an average of 22·3. It was demonstrated that the eggs would not hatch under conditions as dry as those obtaining in the orchard prior to the winter rains, and as oviposition continued in the insectary till the middle of June, it was estimated that hatching lasts in the field from 14 days after the first winter rains till the end of July. By using Dyar's Law [*cf.* xx, 579], which appeared to be applicable, it was calculated that there were 10 larval instars. Throughout the winter, the larvae fed, between 3 and 12 ins. below the surface of the soil, on the roots of all the annuals grown as cover-crops in the orchards, but not normally on apple roots [*cf.* xv, 215]. Most of them pupated after 5 months (in October) at a depth of 12 ins., but about 10 per cent., which had not passed the seventh instar in September, aestivated through one summer in the subsoil (sometimes as deep as 3 ft.), when the orchards were under clean fallow and they had no food available, and thus prolonged their larval life to 17 months. Adult life also normally lasted about 5 months, but was prolonged by a year in the case of about 11 per cent. of the weevils, which hibernated. Adults that were starved from 20th December to 3rd January continued to feed until 20th January, although the others had ceased feeding on 5th January and entered on an inactive period [*cf.* xix, 467] that lasted till 20th February. They have been observed feeding on 21 different plants, representing 12 families. Feeding and oviposition occurred only at night. Most of the eggs were laid (in nature probably on or under the surface of the soil) in autumn, but a few

in spring after hibernation. The average number laid by one female was 50·8. Reproduction was parthenogenetic, and no males were observed.

Uvarov (B. P.). **Ecology of the Moroccan Locust in Iraq and Syria and the Prevention of its Outbreaks.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 407–418, 1 pl., 1 map, 3 graphs, 7 refs. London, September 1933.

An account is given of the results obtained in 1932 in continued studies of *Dociostaurus maroccanus*, Thnb., in the Near East [*cf. R.A.E.*, A, xx, 548]. The physiography of the areas in Syria, southern Turkey and Iraq that are subject to the invasions of this locust is described, and a map shows the limits of invasions and the approximate distribution within it of the " reservations " in which the outbreaks can originate. They were found to occur in a narrow zone on the lower slopes of mountains, at an altitude of 650–1,300 ft. above sea-level, beginning south-eastwards of Khanaqin, Iraq, probably near Mandali and in the adjoining Persian territory, and stretching in a curved belt 30–40 miles wide through Kifri, Kirkuk and Arbil to Mosul. In the north-west, this belt broadens out and turns westwards into Syrian, and perhaps Turkish, territory. Within this restricted zone, the reservations are confined to slopes with hard, pebbly soil and a characteristic vegetation of low stunted plants, which are enumerated and which form an open association. In the Jezireh country of Northern Iraq and Syria, they are confined to round hillocks or " tels," the soil of which is hard and pebbly and which probably represent secondary reservations at which the locusts have been forced to concentrate owing to the spread of cultivation. The climate of the reservation zone, which lies in the vicinity of the 375 mm. isohyet and in which most precipitation falls in December–February, while the summer months are practically rainless, is discussed and compared to that of the reservations in western Anatolia [*loc. cit.*].

The following measures for preventive locust control are advocated. All oviposition areas should be annually surveyed and recorded on large-scale maps, a series of which extending over a few years would show which places are always chosen for laying. In addition, ecological studies should be carried out by an entomologist, in co-operation with a botanist, of all the reservations in order to discover the actual conditions causing them to be chosen. The outcome of the topographical and ecological work would be a map showing the exact distribution of the reservations, which could then be kept under strict supervision, in order to suppress by ordinary control measures the first attempts of the solitary locusts to congregate. Moreover, with the knowledge gained during ecological work, it will be possible to change the conditions in reservations so as to make them unsuitable for locusts. For example, in northern Jezireh it would probably be sufficient to plough over the " tels " to make them unacceptable for oviposition for two years.

Uvarov (B. P.). **Preliminary Experiments on the Annual Cycle of the Red Locust** (*Nomadacris septemfasciata*, **Serv.**).—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 419–420. London, September 1933.

Eggs of *Nomadacris septemfasciata*, Serv., laid in January 1933 in Northern Rhodesia and sent to London, were kept in wet sand at temperatures of 100°F. by day and 80° by night, which were maintained throughout the experiment. The hoppers, which began to hatch in

early March and were kept at a relative humidity approaching 100 per cent., reached the adult stage in 6½ weeks. Some of the adults were kept at a relative humidity of 30–40 per cent., others at 70–90 per cent.; both lots laid eggs in June, the former only a few days after the latter, and hoppers hatched in about 6 weeks.

It is concluded that the normal life-cycle of this locust in its breeding places south of the equator, where it breeds in the rainy season (November–March) and the adults pass 7–9 months in a sexually immature state, is not a fixed hereditary character, but is dependent on the actual seasonal cycle. The immature adults undertake long migration flights, apparently in connection with seasonal shifting of the rain belts, to the north and west, reaching as far as Uganda and the interior of the Belgian Congo, and returning later, south and east, without having bred. It is suggested that if, during their migrations, they should reach areas with a sufficiently wet and hot climate, they might attain sexual maturity and breed.

James (H. C.). **The Biology and Control of *Asterolecanium coffeae*, Newst., the Fringed Scale of Coffee, in Kenya Colony.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 421–427, 1 pl., 3 figs., 5 refs. London, September 1933.

Descriptions are given of all stages of the female of *Asterolecanium coffeae*, Newst., a pest of *Coffea arabica* in Kenya, Tanganyika and Uganda, with notes on its natural enemies and control [*R.A.E.*, A, xxi, 108]. In Kenya, the life-cycle from hatching to oviposition occupied 60–70 days, the first instar lasting 7–12 days, the second 18–25 and the pre-oviposition period 28. The average number of eggs laid was 50. Males were very rare. Loquat (*Photinia japonica*) and *Jacaranda* sp. were alternative food-plants. On the young twigs of coffee, the scales are most commonly found at the node near the base of a leaf-petiole, where they deprive the leaf of its sap and cause it to turn black and droop. Heavy infestation may entirely destroy the current season's crop and the after-effects, which include warping of the crop-bearing wood and sometimes the production of long, whip-like branches, are more serious than those caused by any other scale pest of coffee in the Colony. Infestation is heaviest on coffee between 4,000 and 5,000 ft., and is probably increased by a deficiency of humus in the soil. Control is very difficult, because the scales are embedded in small depressions in the green wood and protected by horny tests, which resist the disintegrating action of 15 per cent. caustic potash (potassium hydroxide) at 15°C. [59°F.] for 24 hours. In heavily infested plantations, the trees should be stumped to within 1 ft. of the ground and the stumps scrubbed with Orthol K (which is also the best spray material) and whitewashed [*loc. cit.*]. As the scales reproduce most rapidly in the two dry seasons (generally March and October), the best time for spraying is near the end of either rainy season. For light foliage infestations, careful pruning may be of value, if the twigs are collected and burnt.

James (H. C.). **Taxonomic Notes on the Coffee Mealybugs of Kenya Colony.**—*Bull. Ent. Res.*, xxiv, pt. 3, pp. 429–436, 1 pl., 1 fig., 4 refs. London, September 1933.

In the Philippine Islands, whence it was first described, *Pseudococcus lilacinus*, Ckll., is stated to be viviparous or ovoviviparous [*cf. R.A.E.*,

A, xx, 669]. In Kenya, where it is the principal mealybug attacking coffee (*Coffea arabica*), it is invariably oviparous in the laboratory, though from the relative scarcity of eggs under actively breeding females in the plantations it appears to be commonly ovoviviparous. As the external incubation period under the same conditions in the laboratory varied, this is not a reliable criterion of the identity of the species [*cf.* xxi, 33]; the possibly greater tendency to deposit eggs in Kenya than in the Philippines may be due to environment. It is possible that in some situations *P. lilacinus* might be almost entirely oviparous, the duration of the egg stage (external) being considerable, in which case the ovisac would be voluminous (as in *P. citri*, Risso), as the apparently small ovisac of *P. lilacinus* is due to its continual dispersal by the rapidly hatched progeny. Mealybugs similar to *P. lilacinus* in Kenya have been found in Uganda and Tanganyika. Characters are given by which *P. lilacinus* and *P. citri* may be distinguished. Trees infested with the latter have a more "cottony" appearance owing to the presence of large ovisacs and numerous male cocoons on the foliage, the males of *P. lilacinus* more often pupating at the base of the trees or in the soil.

The root-infesting mealybugs, believed to be a form of *P. citri* [xxi, 33], are widely distributed in East Africa as minor pests of coffee and other plants, including tomato. They have also been found, in association with *Eriosoma* sp., on the roots of peppermint (*Mentha piperita*) in Kenya. They are attended by ants, particularly an underground species, *Solenopsis punctaticeps*, Mayr.

Other mealybugs dealt with briefly are *P. virgatus*, Ckll., and *P. perniciosus*, Newst. & Willc., which are easily recognised in the field and which are recorded from various food-plants besides *Coffea arabica*, *P. longispinus*, Targ., which appears to be recorded for the first time on coffee in Kenya, and *P. simulator*, sp. n., which was formerly confused with *P. comstocki*, Kuw. [xxi, 33]. *P. simulator* has not been recorded since 1926, when it was first collected.

GARDNER (J. C. M.). **Immature Stages of Indian Coleoptera (13) (Bostrychidae).**—*Ind. For. Rec.*, xviii, pt. 9, 19 pp., 4 pls., 12 refs. Delhi, 1933. Price 1*s.* 9*d.*

Descriptions are given of the larvae of a number of Bostrychids (including Lyctids), with keys to them and to the subfamilies and tribes so far as these are represented.

GÁNDARA (G.). **La hierba de la langosta.**—*Mem. Soc. "Ant. Alzate,"* li, pp. 107–114, 1 fig. Mexico, 1931.

In Salvador the author observed a leguminous plant covered with hoppers of *Schistocerca paranensis*, Burm., which had been caught by the hooked hairs on it and were destroyed by ants. It is here described as *Meibomia trigona*, sp. n., and the planting of it around crops is suggested as a method of controlling locusts.

TEODORO (G.). **Considerazioni sulle cocciniglie e loro piante nutrici.** [Notes on Coccids and their Food-plants.]—*Boll. Zool.*, iv, no. 2, pp. 69–73, 11 refs. Turin, April 1933.

Additions, based on Takahashi's publications on the Coccids of Formosa [*R.A.E.*, A, xxi, 198, etc.], are made to the table in a previous paper by the author [xv, 202].

Barbieri (N. A.). **La tabacina o il principio tossico del tabacco.** [Tabacin or the Toxic Principle of Tobacco.] **Azione insetticida del tabacol.** [The Insecticidal Action of Tabacol.]—*Rend. Accad. naz. Lincei*, Cl. Sci. fis. mat. nat., (6) vii, pp. 764–768 ; xvii, no. 5, pp. 402–409, 3 figs. Rome, 1928 & 1933.

The first of these papers describes methods of analysing tobacco. One of the fractions obtained contains tabacin, a glucoside with a distinct acid reaction, highly soluble in water or alcohol, but insoluble in ether. A 2 per cent. cold potash lye divides it into its components, tabacol, tabacinic acid and sugar. At 110°C. [230°F.], tabacin produces irritant vapours of tabacol. When treated with a hot concentrated potash lye, tabacin loses a large amount of ammonia and changes into nicotine.

The second paper begins with a very brief discussion of the various types of insecticides in common use. The author states that organic chemicals do not form salts and that the commercial product known as nicotine sulphate, which is a solution of nicotine in sulphuric acid, contains 20–25 per cent. free sulphuric acid and causes severe injury to plants. He considers tabacol to be an ideal insecticide, as it acts on the nervous system of insects, causing instant paralysis, and does not injure plants, even at 100 per cent. strength. It has an alkaline reaction and is highly soluble in water. Between 40 and 60°C. [104–140°F.] it emits irritant, poisonous vapours. Insects (including *Lasioderma serricorne*, F.), spiders and worms placed in a litre flask in which 1 cc. of tabacol had been vaporised were killed at once. A solution of 1 per mille may be used as a preventive spray, while one of 1 per cent. destroyed Aphids. Within 1 minute, a 2 per cent. solution killed *Lepidosaphes pinnaeformis*, Bch., *Heliothrips haemorrhoidalis*, Bch., *Tetranychus telarius*, L., *Aspidiotus hederae*, Vall., and ants. Dipterous leaf-miners were killed by fumigation or by immersing the leaves for an hour in a 2 per cent. solution. In hot-houses, a 2 per cent. solution should be used, as the tabacol left on the leaves after the water has evaporated prevents reinfestation for some time. A 1 per cent. solution injected into the soil killed worms without injury to the roots of plants. In experimental work in 1932 in France and Belgium and in 1933 in Italy, a 2 per cent. solution destroyed pests on a large number of plants without any injury to the foliage.

Blunck (—). **Die Umstellung im Getreidebau und die Pflanzenkrankheiten.** [Changes in Cereal Crops and Plant Diseases.]—*Mitt. deuts. Landw. Ges.*, xlviii, pp. 262, 286, 377, 1933. (Abstr. in *Z. PflKrankh.*, xliii, no. 10, pp. 620–621. Stuttgart, 1933.)

The recent increase in acreage in Germany under wheat and rye at the expense of oats, barley and oil crops must result in an increase of the diseases and pests of the former. Indications of this are given.

Rademacher (B.). **Gedanken zu der geplanten Ausdehnung des Oelfruchtanbaues vom Standpunkte des Pflanzenschutzes.** [Reflections from the Point of View of Plant Protection on the projected Extension of the Cultivation of Oil Crops.]—*Mitt. deuts. Landw. Ges.*, xlviii, p. 520, 1933. (Abstr. in *Z. PflKrankh.*, xliii, no. 10, p. 621. Stuttgart, 1933.)

Endorsing Blunck's views [see preceding abstract], the author welcomes the proposed extension of the cultivation of cruciferous oil

crops planned in Germany, as it entails an increase in rotation and diversity of crops. The outbreaks in past years of such pests of oil crops as *Ceuthorrhynchus assimilis*, Payk., *C. quadridens*, Panz., *Psylliodes chrysocephala*, L., and *Dasyneura* (*Cecidomyia*) *brassicae*, Winn., have been checked by the recent enormous decrease in the cultivation of these crops and can be avoided in future by crop rotation in large areas. Even the rape beetle [*Meligethes aeneus*, F.] could be reduced to a great extent. The possibility of controlling pests by regulation of the kind of crop is discussed.

TORKA (V.). *Ips cembrae* **Heer und** *Dendroctonus micans* **Kug. in Oberschlesien.**—*Ent. Bl.*, xxix, no. 3, pp. 120–121. Berlin, September 1933.

In Upper Silesia, *Ips cembrae*, Heer, is very common in larch near Neustatt. *Dendroctonus micans*, Kug., which is less common, breeds in healthy spruce trees, sometimes killing them.

Importation of Plants, Fruit, etc., into Cyprus.—*Leafl. Dept. Agric. Cyprus*, no. 20, 6 pp. Nicosia [1933].

The substance of the regulations laid down in the Cyprus Orders in Council No. 1421 of 23rd April 1931 and No. 1481 of 29th June 1932 is given. These Orders are designed to prevent the introduction into Cyprus of any injurious insects and fungous diseases not at present occurring there.

Service and Regulatory Announcements, January-March 1933.—*U.S. Dept. Agric.*, B.P.Q., S.R.A., no. 114, pp. 137–175. Washington, D.C., June 1933.

In addition to official announcements in connection with quarantines against insect pests in the United States, many of which have already been noticed, plant quarantine restrictions issued by the following countries are summarised : Brazil, Greece, Chile, Australia, Guatemala, Sweden and Norway. A review of the State regulations issued on account of *Pyrausta nubilalis*, Hb., up to 16th March 1933 supersedes that already noticed [*R.A.E.*, A, xxi, 422].

PAPERS NOTICED BY TITLE ONLY.

HILLE RIS LAMBERS (D.). **A new Genus and some new Species of Aphids** [including *Macrosiphum brachytarsus* on *Cajanus indicus* in Nyasaland.]—*Stylops*, ii, pt. 9, pp. 197–201, 1 fig., 3 refs. London, 15th September 1933.

MILLER (F. W.). **A new Oak Aphid from Massachusetts.**—*Canad. Ent.*, lxv, no. 8, pp. 183–184, 1 fig. Orillia, Ont., August 1933.

HINDS (W. E.), OSTERBERGER (B. A.) & DUGAS (A. L.). **Sugar Cane Borer** [*Diatraea saccharalis*, F.] **Control by** *Trichogramma* [*minutum*, Riley] **Colonisation in Lousiana in 1932.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 758–767, 1 fig. Geneva, N.Y., August 1933. [*Cf. R.A.E.*, A, xxi, 225.]

WALTHER (E.). **A practical Method** [Ethylene Dichloride] **of Controlling** *Dendroctonus valens* **Lec.**—*J. Econ. Ent.*, xxvi, no. 4, pp. 828–831, 2 pls., 2 refs. Geneva, N.Y., August 1933. [For briefer account, see *R.A.E.*, A, xxi, 193.]

FISHER (H. J.) & BAILEY (E. M.). **The Composition of some Commercial Insecticides, Fungicides, Bactericides, Rodenticides and Weed Killers. A Compilation, Supplement to Bulletin 300.**—*Bull. Conn. Agric. Expt. Sta.*, no. 346, pp. 211–268. New Haven, Conn., February 1933. [Recd. October 1933.] [*Cf. R.A.E.*, A, xviii, 161.]

[ROMANOVICH (I. K.).] **Романович (И. К.). Nicotine, Neonicotine and Anabasine. (A Summary of the Literature.)** [*In Russian.*]—*Plant Prot.*, 1932, no. 1, pp. 51–55, 4 figs., 10 refs. Leningrad, 1932. [Recd. September 1933.]

[ROMANOVICH (I. K.).] **Романович (И. К.). On the Solubility of Insecticides and Fungicides. (A Review of the Literature.)** [*In Russian.*]—*Plant Prot.*, 1932, no. 2, pp. 41–52, 26 refs. Leningrad, 1932. [Recd. September 1933.]

[ROMANOVICH (I. K.).] **Романович (И. К.). Contemporary Methods for estimating the Adhesive Strength of Insecticidal and Fungicidal Dusts. (A Review of the Literature.)** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 1–16, 16 refs. Leningrad, 1933.

[NIKOL'SKAYA (M. N.).] **Никольская (М. Н.). The Principles of Biological Control of Injurious Insects by Means of Egg Parasites g. *Trichogramma* (Hym. Chalcididae). (A Review of the Literature.)** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 25–34, 65 refs. Leningrad, 1933.

[BAZDUIREVA (V. I.).] **Баздырева (В. И.). The Fluted Scale (*Icerya purchasi* Mask.) and its Control. (A Review of the Literature.)** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 35–64, 92 refs. Leningrad, 1933.

SHIRAKI (T.). **A systematic Study of Trypetidae in the Japanese Empire.**—*Mem. Fac. Sci. Agric. Taihoku Imp. Univ.*, viii (Ent. no. 2), 509 pp., 14 pls., 92 figs., 7 pp. refs. Taihoku, Formosa, July 1933.

LABOISSIÈRE (V.). **Chrysomelidae nouveaux de l'Indo-Chine et de la presqu'île de Malacca** [including the Galerucid, *Arthrotus duporti*, sp. n., on beans (*Phaseolus*) in Tonkin.]—*Ann. Ass. Nat. Levallois-Perret*, xx (1914–31), pp. 130–142, 4 figs. Levallois-Perret, 1932.

HUTSON (J. C.). **Report on the Work of the Entomological Division.**—*Adm. Rep. Dir. Agric. Ceylon 1932*, pp. D 123–133. Colombo, 1933. [See *R.A.E.*, A, xxi, 361.]

MANUNTA (C.). **Sul metabolismo dei grassi nella tignuola degli alveari** (*Galleria mellonella*). [On the Metabolism of Fats in *G. mellonella*, L.]—*Rend. Accad. Lincei*, Cl. Sci. fis., mat. nat., (6) xvii, no. 4, pp. 309–312. Rome, 19th February 1933.

JANDA (V.). **O vývoji a spotřebě kyslíku isolovaných částí těla kukel potemníka moučného** (*Tenebrio molitor* **L.**). [On the Development and Oxygen Requirements of isolated Parts of Pupae of the Flour Beetle, *T. molitor*.]—*Acta Soc. ent. česchoslov.*, xxx, nos. 1–3, pp. 22–27, 52–55, 93–96, 3 figs., 9 refs. Prague, 1933. (With a Summary in German.)

CONTENTS.

[MEÏER (N. F.) & TELENGA (N. A.).] **Мейер (Н. Ф.) и Теленга (Н. А.). Ueber biologische Bekämpfung der Blutblattlaus** (*Eriosoma lanigerum* **Hausm.) durch ihren Parasit**—*Aphelinus mali* **Hald. in USSR.** [On the biological Control of *E. lanigerum* by means of its Parasite, *A. mali*, in the U.S.S.R.] [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 17–24, 4 figs., 1 diagr. Leningrad, 1933 (With a Summary in German.)

An account is given of the establishment in 1931 of *Aphelinus mali*, Hald., in the Crimea and the North Caucasus for the control of *Eriosoma lanigerum*, Hausm., which is an important pest of apples in the Russian Union. In the autumn of 1930, material parasitised by the Aphelinid was received in Leningrad, chiefly from Italy, and one generation was reared before hibernation began. In 1931, 12 complete generations were reared in the insectary and on apple trees infested by the Aphid in greenhouses, in which the parasites were very active, laying 65–101 eggs, not more than one in each Aphid.

In the Crimea, 531 females were placed in small muslin cages attached to branches of apple infested by *E. lanigerum* in various parts of a botanical garden, so as to establish a number of breeding foci. After a few days, the cages were removed to allow the adults of the new generation to spread. From the beginning of May till the end of October, the parasite produced eight complete generations and a partial ninth, their duration depending on temperature and humidity, and varying from 16 to 27 days. The individuals of the eighth generation that were in the larval stage in the second half of September entered hibernation owing to a sharp decline in the temperature, but those that had pupated emerged as adults during a spell of warm weather and oviposited, the resulting larvae entering hibernation in October. The period during which adults were emerging varied greatly for the different generations, lasting 5 days in May and 24 in October. The adults are especially active on sunny days, but avoid the direct rays of the sun, so that parasitism was highest on trees with dense crowns and on the shady side of the trees. They do not fly far in the absence of wind.

By the middle of the summer, the parasite was so well established that liberations were made in other localities in the Crimea, where towards autumn it produced a parasitism of 50–80 per cent., and in the North Caucasus, where it also proved to be very active. Surveys in the spring of 1932 showed that it had withstood the severe winter in the Crimea, and the authors believe that it is fully established.

Two Pteromalid hyperparasites were bred from it in the Crimea, *viz.*, *Pachyneuron aphidis*, Bch., which parasitised 0·1–2·3 per cent., and a single example of *Asaphes vulgaris*, Wlk. [*cf.* *R.A.E.*, A, xx, 183].

[SHCHEGOLEV (V. N.).] **Щеголев (В. Н.). On the Economic Importance of** *Etiella zinckenella* **Tr.—a Pest of Soy Beans.** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 66–70, 6 refs. Leningrad, 1933.

Nearly 140,000 acres or about a third of the total area under soy beans in the North Caucasus were examined in 1930, samples of pods being taken at regular intervals with a view to collecting data on infestation by *Etiella zinckenella*, Treit. [*cf.* *R.A.E.*, A, xviii, 97]. The results are given in a table showing the extent of the areas that suffered from different percentages of infestation, which varied from 1–10 to over 75. On the assumption, supported by data from the

literature and personal observations, that 75 per cent. of the seeds in infested pods are destroyed or have to be discarded, it was estimated that the loss sustained amounted to 6·2 per cent. of the crop. It was probably equally severe over the whole area under soy beans in the North Caucasus.

[Chugunin (Ya. V.).] **Чугунин (Я. В.). The Effectiveness of jarring off Orchard Weevils under various Conditions.** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 81–99, 1 fig., 2 graphs, 4 refs. Leningrad, 1933.

Severe losses are caused every year in the Russian Union by various species of weevils on fruit trees, and as the common practice of jarring them from the trees on to sheets and destroying them has frequently proved valueless, a careful study was carried out in the spring of 1931 in the Crimea to determine the conditions under which it is effective. Observations were carried out chiefly on *Rhynchites pauxillus*, Germ., which was the only weevil abundant. A series of experiments in which the trees were jarred at various hours from 5 a.m. till 9 p.m. at intervals of 5–10 minutes until they were completely free from weevils showed that, as the temperature rose above a certain limit, the average percentage shaken off by the first stroke markedly decreased. It was highest (84–86) in the early morning hours. After 8 a.m. it gradually decreased until, between noon and 1 p.m., it was only 42·5 and then rose again to 75 at 6 p.m. These observations were confirmed by tests with individual branches on which a known number of weevils had been placed. The results indicated that jarring is economically justified only if carried out at temperatures ranging from about 7·3 to 12·6°C. [45–54·7°F.], when 80–85 per cent. of the weevils drop after the first stroke. Further jarrings would be of no practical value, as even if the temperature is only a little higher (15·3–16·3°C. [59·5–61·3°F.]) the trees have to be jarred at least five times in order to shake off 80–90 per cent. of the weevils.

Experiments with *Anthonomus pomorum*, L., were only conducted with counted individuals on isolated branches. A total of 80–85 per cent. of the weevils fell only after five successive jarrings at 10°C. [50°F.], as against one in the case of *R. pauxillus*. The best results were again obtained at low temperatures. A study in cages of the behaviour of weevils disturbed by jarring showed that 100 per cent. of *R. pauxillus* and *A. pomorum* dropped to the ground at temperatures up to 12·6°C. and 10°C. respectively. As the temperature rose above these limits, an increasing percentage took wing instead of falling, and it appeared that above 22·5°C. [72·5°F.] for *R. pauxillus* and 18·5°C. [65·3°F.] for *A. pomorum*, all would do so.

Tests of the best method of jarring showed that all weevils can be brought down by three sharp strokes applied at regular intervals of not more than a few seconds to branches of not more than 3 ins. in diameter.

Three jarrings a year are required, the first two against *A. pomorum*, *Rhynchites bacchus*, L., and *R. pauxillus*, and the third against *R. pauxillus*, *R. bacchus* and *R. aequatus*, L. The first must be done while the buds are swelling and drops of moisture appear on them as a result of the punctures caused by the adults of *A. pomorum*, the second while the buds are bursting, and the third during the time that the individual flowers are becoming separated.

[IL'INSKIĬ (A. M.) & VOROB'EVA (K. S.).] **Ильинский (А. М.) и Воробьева (К. С.). On the Substitution of other Materials for Copper in Machinery for the Control of Pests and Diseases.** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 100–105. Leningrad, 1933.

In view of the great need of copper in the Russian Union for industrial purposes, investigations were made on the possibility of replacing the copper parts in spraying machinery by iron coated with various materials. Small iron plates were electroplated with a thin layer (0·05 mm.) of copper on nickel and others coated with bakelite or a varnish, and placed in glasses containing solutions of various chemicals used as insecticides or fungicides. There was hardly any difference in the chemical changes that took place in solutions containing control iron plates and in those containing plates electroplated with copper. The best results were obtained with bakelite, but owing to the complexity of the processes used in its preparation and its insufficient plasticity, it does not appear suitable for the purpose. The next best were two of the three varnishes tested.

[ZAKHAROV (L. Z.).] **Захаров (Л. З.). A Theory of Migrations of the Migratory Locust.** [*In Russian.*]—*Plant Prot.*, 1932, no. 3, pp. 123–130, 2 graphs, 5 refs. Leningrad, 1933.

The activity of *Locusta migratoria*, L., in the North Caucasus is discussed, and the hypothesis is advanced that any movement of the locust indicates that it is not in an optimum condition and is trying to gain one.

Hunger, deficiency or excess of heat or humidity and gregariousness all act as stimuli, producing an impulse to change the position of either the separate organs or the whole body. The optimum conditions are accompanied by the minimum amount of movement, and in the ideal state by its complete absence. This quiescent state should be distinguished from heat and cold stupors, during which the responsiveness of the organism to stimuli is lowered or completely lost, for during optimum conditions the insect remains capable of immediate reactions to any external stimulus.

The scheme of the daily reactions of the hoppers to heat is outlined, and it is stressed that the effect of any one factor is only relative and does not in itself direct behaviour, which is determined by the sum of all the external factors, with one guiding factor for each particular physiological state. The daily scheme of behaviour of hoppers is given in some detail, and it is shown that the guiding rôle constantly passes from one factor to another. The mass movement of the hoppers brought about by high temperatures is greater when the relative humidity of the air is low (40–30 per cent.), and in such cases the direction of the movement is determined by the most humid currents of air. On cloudy, cool days when the external factors are indefinite, the behaviour of the hoppers becomes indefinite also, and there is no simultaneous movement in one direction.

The seasonal behaviour of locusts is determined as much by the seasonal changes in weather as by the physiological changes within the organism, and there is no qualitative difference between the behaviour of hoppers and that of adults, which are directly comparable. The seasonal behaviour of *L. migratoria* in the North Caucasus is described,

and it is suggested that the migrations of swarms from reed-beds into drier and warmer steppes where they breed is caused by excessive coolness and dampness prevailing in the former during the autumn.

KALTENBACH (R. G.). **Etude sur les poudrages antidoryphoriques.**—Med. 8vo, [4] 70 [1] pp., 17 figs., 2 graphs, 5 refs. Paris, Etabl. Busson, 1932. [Recd. October 1933.]

This report has been prepared for officers of the French agricultural research services, and will be followed by a popular edition for general use. In it the author summarises his experiments on the control of *Leptinotarsa decemlineata*, Say, on potato by means of dusts containing arsenicals or fluorine compounds. Various types of dusting equipment are discussed, as well as the different insecticides. It is concluded that barium fluosilicate is likely to replace arsenical preparations on the grounds of efficiency, economy and freedom from legislative restrictions.

VAPPULA (N. A.). **Syyskääriäisestä** (*Exapate congelatella* **Cl.**) **ja sen tuhoista.** [On *E. congelatella* and the Damage it causes.]—*Luonnon Ystävä*, xxxvii, no. 2, pp. 44–49, 2 figs. Helsingfors, 1933.

A brief account is given of the morphology, bionomics and distribution of the Tortricid, *Exapate congelatella*, Cl. In Finland, the adults emerge in autumn, chiefly in October, and lay eggs singly or in small groups on twigs of the food-plant [*cf. R.A.E.*, A, xx, 87]. The larvae hatch in late May and sometimes cause serious injury in June to currants and gooseberries, usually in company with *Tortrix* (*Cacoecia*) *rosana*, L., as well as to apple and *Caragana arborescens*. They have also been found on strawberries, plum, *Spiraea salicifolia*, *Lonicera* sp., eim and *Myrica gale*. Dusting with arsenicals and winter spraying with a tar distillate are recommended for control.

Suomen Kasvinsuojelusseuran Julkaisuja N:o 2. [Publications of the Plant Protection Society of Finland, no. 2.]—16 pp., 7 figs. Helsingfors, 1933.

This publication includes the following papers: Plant Protection and its Advancement in Finland, by A. Hilli; The Importance of Cultural Measures in Plant Protection, by N. A. Vappula; On the Need for Plant Protection in Orchards, by J. Listo; and The Progress of the Plant Disease and Pest Report Service, by E. J. Kinnunen.

PETCH (T.). **Notes on Entomogenous Fungi.**—*Trans. Brit. Mycol. Soc.*, xviii, pt. 1, pp. 48–75. Cambridge, August 1933.

The species dealt with in this paper include: *Ophiocordyceps* (*Cordyceps*) *clavulata* (*pistillariaeformis*), which attacks scale insects and is common in the United States, having also been recorded several times from Europe and once from England; and *Isaria orthopterorum*, sp. n., which was found on Orthoptera in Ceylon and North Siam.

Smith (K. M.). **Some Virus Diseases of the Potato and other Farm Crops.**—*Scot. J. Agric.*, xvi, no. 4, pp. 446–456, 2 figs., 3 pls. Edinburgh, October 1933.

This paper contains information on the virus diseases of various crops in the British Isles and their insect vectors, especially those that infect potato and are transmitted by Aphids [*cf. R.A.E.*, A, xviii, 519 ; xix, 459, 583 ; xxi, 428 ; etc.].

Gray (R. A. H.) & Brooks (H. E.). **Winter Spraying against the Apple Capsid Bug on mixed Varieties of Apple Trees.**—*J. Minist. Agric.*, xl, no. 7, pp. 630–635, 1 pl. London, October 1933.

A localised outbreak of *Plesiocoris rugicollis*, Fall., occurred in an apple orchard in Cumberland in 1929, appreciable damage being caused to the foliage and fruit, and the attack increased in intensity during 1930 and 1931. In January–March 1932, tests were made on trees of several varieties with ovicidal washes of tar distillate and mineral oil, applied in combination, except in one instance in which the same trees were treated with tar oil on 1st February and mineral oil on 14th March. The results varied considerably, but a proprietary mixed wash (mineral oil emulsion and Long Ashton modified tar-oil wash [*R.A.E.*, A, xvii, 673], 2 : 1) at a concentration of 10 per cent. and a wash containing 5 per cent. tar distillate and 7½ per cent. mineral oil emulsion reduced the percentages of marked fruit to 2·2 and 2·8 respectively, as compared with 52·6 and 22·9 in two unsprayed rows. At lower concentrations, the washes were less satisfactory.

Examination on 2nd June of the number of damaged blossom shoots, the results of which are tabulated, indicated that there is no regular correlation between this and the yield of apples.

Aphids, apple suckers [*Psylla mali*, Schmidb.] and the larvae of winter moth [*Cheimatobia brumata*, L.] were scarce on the sprayed trees in June and fairly numerous on the unsprayed ones. The washes did not seem to affect the buds or the time of fruiting, and they improved the appearance of the foliage.

Munro (J. W.). **The Fumigation of stored Products affected by Insects.**—*J. R. Sanit. Inst.*, liii, no. 10, reprint 5 pp., 1 ref.

Page (A. B. P.). **The Control of Insects on Foodstuffs and other Raw Material by Fumigation. The Chemical and Physical Aspects.**—*T.c.*, pp. 582–587. London, 1933.

In the first of these papers, the author points out that, though the sterilisation by physical and chemical agencies of infested produce is only a palliative, it promises to be more easily attainable than the elimination of infestation at its source [*R.A.E.*, A, xxi, 112]. In the course of five years' work, chiefly on *Ephestia elutella*, Hb., *E. kühniella*, Zell., and *Plodia interpunctella*, Hb., it was found that eggs and resting or hibernating larvae frequently survive concentrations of fumigant fatal to active larvae, pupae and adults. Toxicity tests should be carried out on laboratory-bred insects, and a sufficient number in all stages should be used to allow for variations in resistance, whether inherent or resulting from injury or disease. Collections made at random and including a wide range of species are useless. Full allowance must be made for the proportion of naturally infertile eggs.

The second paper deals with chemical problems such as the choice of a fumigant that will exterminate the insects without damaging the goods ; the determination of the amount absorbed ; and the finding of satisfactory methods for sampling the air in the fumigation chamber and determining the fumigant in the sample. Types of apparatus used for the measurement of gas concentration are described [xxi, 111]. In the course of repeated samplings, it was found that the average of the maximum concentrations reached at various points in a building is seldom more than half that calculated from the dosage ; the maximum generally occurs in the free space about half an hour from the start, and inside packages after a longer period. The method of release of the fumigant has been shown to be important. Heat ensures complete gasification and assists distribution by means of convection currents. When using liquid fumigants sprayed from jets, it is essential to leave sufficient clear space to avoid wastage, spoilage of goods and retention of dangerous amounts of fumigant. If heat is not supplied, the release should be made at the extreme top of the chamber, as the mixture of fumigant and cold dense air descends very quickly. Where commercial conditions permit, it is a great advantage to use special chambers. The type used for vacuum fumigation is described, as well as the experimental plant at Slough for the study of vacuum fumigation, which is designed to deal with the largest sacks used in Britain.

Laidlaw (W. B. R.). *Megastigmus* **in Scotland ; with an Addition to the Scottish List.**—*Scot. For. J.*, xlv, pt. 2, pp. 177–193, 2 pls., 2 figs., 28 refs. Edinburgh, October 1931. [Recd. October 1933.]

Descriptions are given of all stages of the Torymid, *Megastigmus pinus*, Parf., which was found in seeds of *Abies nobilis* at Balmoral, Scotland, in 1930. Adults emerged from the seeds in May–June, and mated females laid eggs in the tender ovules of flowering cones. By September, the larvae had completed their growth inside the seeds, in which they then hibernated. Pupation took place in April–May, 3 weeks before emergence. A key is given to the females of *M. pinus*, *M. pictus*, Först. (*strobilobius*, Ratz.), which has been reported from *Abies* in Britain, *M. spermotrophus*, Wachtl, which is sometimes a serious pest of Douglas fir [*Pseudotsuga taxifolia*] in Britain [*R.A.E.*, A, x, 368], and *M. suspectus*, Borries, which emerged in Aberdeen from seeds of *A. nordmanniana* imported from the Caucasus.

Chrystal (R. N.) & Skinner (E. R.). **Studies in the Biology of the Woodwasp** *Xiphydria prolongata* **Geoffr.** (*dromedarius* **F.**) **and its Parasite** *Thalessa curvipes* **Grav.**—*Scot. For. J.*, xlvi, pt. 1, pp. 36–51, 16 figs., 10 refs. Edinburgh, March 1932. [Recd. October 1933.]

An account is given of laboratory observations on *Xiphydria prolongata*, Geoffr., with material taken from willow logs near Oxford in 1928 and 1929. The characters differentiating the Siricinae and Xiphydriinae, and *Xiphydria prolongata* from *X. camelus*, L., which is recorded from alder in Britain, are given, and the literature on the European species of this genus is briefly reviewed. All stages of *X. prolongata* are described. In 1929, emergence continued from 17th June till about mid-August ; in 1930, the peak occurred in the

latter part of August. The females laid batches of 2–19 eggs under the bark of green willow logs, 4–6 ins. in diameter, preferring deep, longitudinal grooves where the bark was thinnest (2–3 mm.). One female contained an average of 75–85. The egg-stage lasted 15 days, and the larval over 10 months. The larvae tunnelled along the outside of the sapwood and then gradually penetrated to an average depth of about 1¼ ins., but much deeper in logs cut up into 6-inch sections. They pupated in cells in the tunnels, the prepupal and pupal periods totalling 3–4 weeks. The young adults emerged in about a day through circular exit holes. The total life-cycle was completed in one year; in very dry logs, however, the larval period can be more prolonged.

The Ichneumonid, *Thalessa curvipes*, Grav., was the only parasite observed. It had one generation a year, overwintering as a fourth-instar larva in the tunnel made by the host and pupating in a cocoon in early spring. Emergence continued from mid-May to early July; females were rare before June. The egg is laid on the body of the host larva, which has been previously paralysed; it hatches in about 3 days, and the larva reaches its fourth instar in about 12 days. Other parasites of *Xiphydria* are briefly reviewed from the literature.

LAIDLAW (W. B. R.). **Two British Parasites of** *Pissodes*.—*Scot. For. J.*, xlvii, pt. 1, pp. 24–31, 1 fig. Edinburgh, March 1933. [Recd. October 1933.]

Descriptions are given of the adults of the Braconid, *Calyptus mucronatus*, Thoms., reared from the weevil, *Pissodes validirostris*, Gyll., and of the Ichneumonid, *Ephialtes crassiseta*, Thoms., from *P. notatus*, F., both having been found on Scots pine [*Pinus sylvestris*] in Scotland. The eggs are laid in early summer, those of the Braconid in larvae inside green cones, and those of the Ichneumonid on larvae under bark.

KRIEG (H.). **Erfahrungen bei der letzten Bekämpfung der Forleule.** [Experiences during the last Campaign against the Pine Noctuid.] —*Forstarchiv*, ix, no. 17, pp. 275–276, 1 fig. Hanover, 1st September 1933.

In view of the abundance of *Panolis flammea*, Schiff., at Neuendorf near Potsdam [*cf. R.A.E.*, A, xxi, 38, 297] and in other districts in Germany in 1932, a campaign against it was organised in 1933 over an area of about 50,000 acres. Aeroplanes and power dusters were used to apply about 1,000 tons of contact insecticides. It was found that an aeroplane must fly not more than 10–25 ft. above the tree-tops to ensure a thorough application. Aeroplanes were able to dust over 250 acres a day each, and sometimes more than twice that area. The power dusters were used for small or scattered stands. The larvae began falling off the trees within a few minutes; sometimes 40–50 or even about 90 were counted per square foot. A mortality of 98–100 per cent. was achieved, except in a few places where the dust had failed to envelop the crowns or proper attention had not been paid to weather conditions.

ZACHER (F.). **Uebersicht der deutschen Spinnmilben.** [A Survey of the German Spinning Mites.]—*Mitt. zool. Mus. Berlin*, xix, pp. 584–589. Berlin, September 1933.

Keys are given to the genera and species of Tetranychid mites occurring in Germany, with records of their food-plants and of their distribution in other countries.

REICHERT (A.). **Rosenschädlinge.** [Rose Pests.]—*Kranke Pflanze*, x, no. 3, pp. 34–35, 1 pl.; no. 9, pp. 118–121, 1 pl., 3 refs. Dresden, 1933.

In Saxony, the larvae of the Pterophorid, *Platyptilia rhododactyla*, Schiff., appear on rose, their only known food-plant, about mid-May, probably from overwintered eggs, and attack the young shoots and flower-buds. Pupation usually occurs in mid-June, and emergence continues till early August. The larvae are parasitised by *Apanteles* sp. Adults of the sawfly, *Monardis plana*, Klug, which also occurs only on rose and has one generation a year, emerge in early spring from cocoons overwintered in the ground. The larvae feed in May and June on the tender shoots and, preferably, flower-buds. Those of another sawfly, *Pamphilius inanitus*, Villers, feed (by preference on wild roses) from early June to late July. They shelter in tubes made from leaf-strips, each tube requiring about two leaves, and pupate in the ground at a depth of 3–6 inches without cocoons. Hand-collection is suggested against these three pests, but the larvae of another sawfly, *Caliroa aethiops*, F., which injure the leaves throughout the summer, may be controlled by dusting with sulphur, etc., or by sprays directed against the lower surface of the leaves.

SPRENGEL (L.). **Einiges über die Lebensweise der Kirschmade.** [Some Notes on the Biology of the Cherry Maggot.]—*Kranke Pflanze*, x, no. 5–6, pp. 68–70, 1 pl. Dresden, 1933.

STELLWAAG (F.). **Erfahrungen in der Bekämpfung der Kirschfruchtfliege.** [Experiences in the Control of the Cherry Fruit-fly.]—*T.c.*, pp. 71–72.

LANG (W.). **Zur Bekämpfung der Kirschfruchtfliege.** [On the Control of the Cherry Fruit-fly.]—*T.c.*, pp. 73–74.

THIEM (H.). **Verbreitung und Entwicklung der Kirschfruchtfliege in Deutschland und die Bedeutung ihrer wilden Nährpflanzen.** [The Distribution and Development of the Cherry Fruit-fly in Germany and the Importance of its wild Food-plants.]—*T.c.*, pp. 75–82.

These are popular articles dealing with *Rhagoletis cerasi*, L., on cherry in Germany [*cf. R.A.E.*, A, xx, 234, 441; xxi, 375, 376].

TEMPEL (W.). **Ein noch zu wenig bekannter Kirschschädling, die Kirschblüten- oder Zwetschenmotte** (*Argyresthia ephippiella* **F.).** [A little-known Cherry Pest, the Cherry-blossom or Plum Moth, *A. ephippiella*.]—*Kranke Pflanze*, x, no. 5–6, pp. 83–85, 1 pl. Dresden, 1933.

Notes are given on the bionomics and control of *Argyresthia ephippiella*, F., on cherry in Germany [*cf. R.A.E.*, A, xv, 617; xvi, 612; xx, 183; etc.].

Hähne (H.). **Ueber die Bekämpfung der Zwiebelfliege.** [On the Control of the Onion Fly.]—*Kranke Pflanze*, x, no. 7–8, pp. 100–102, 2 figs. Dresden, 1933.

Much of this information on *Hylemyia antiqua*, Mg., has already been noticed [*R.A.E.*, A, xviii, 431 ; etc.]. In Hanover, Fischer has found that mercury bichloride as used against *Phorbia brassicae*, Bch. [xx, 313] gives excellent results against *H. antiqua* [*cf.* xviii, 78]. In Saxony, the onion plants should be watered in the second half of May with a 0·06 per cent. solution, the application being repeated about a fortnight later.

Langenbuch (R.). **Die Bekämpfung der Spargelfliege.** [The Control of the Asparagus Fly.]—*Kranke Pflanze*, x, no. 7–8, pp. 102–104, 2 figs. Dresden, 1933.

Reference is made to Dingler's results with contact dusts against *Platyparea poeciloptera*, Schr. [*R.A.E.*, A, xxi, 139]. Lieber has found that young asparagus plants overrun with weeds suffer little injury, and that winter cereals (rye or barley) planted at a distance of 8 inches on each side of a row protect the plants from infestation. The cereals must be reaped at the end of June (after the oviposition period is over) to give sufficient light and air for the second growth. If, however, the plants are not close together, a paper cylinder, open at the top, should be placed round each. It should be 12–20 ins. high and 2–3 ft. in circumference according to the size of the plant.

Hahmann (C.). **Blattläuse und übermangansaures Kali.** [Aphids and Potassium Permanganate.]—*Kranke Pflanze*, x, no. 7–8, pp. 104–105. Dresden, 1933.

The practice of using potassium permanganate as a spray [*cf.* *R.A.E*, A, xxi, 585] against leaf Aphids has been gaining ground in Germany among owners of small gardens. The author's tests with 0·2–0·3 per cent. solutions have proved it to be completely ineffective.

Stolfa (E.). **Danni prodotti da vespa in un rimboschimento a Forno di Zoldo (Belluno).** [Injuries produced by a Wasp in a replanted Stand at Forno di Zoldo.]—*Alpe*, xx, no. 4, pp. 144–145, 2 figs. Milan, April 1933. [Recd. October 1933.]

Scars on the bark of young larch plants in a district of Venetia were apparently caused by a small species of *Vespa*. The injury sometimes penetrated to the wood, causing partial or total withering.

Goidanich (A.). **Un nuovo metodo di difesa delle patate da semina contro il** ***Bibio hortulanus.*** [A new Method for protecting Seed Potatoes against *B. hortulanus.*]—*Italia agric.*, lxx, no. 2, pp. 183–186, 3 figs. Rome, February 1933. [Recd. October 1933.]

In April 1931, seed potatoes, planted whole or in pieces, were damaged in the province of Bologna by the larvae of *Bibio hortulanus*, L. The pieces were more readily attacked, but the larvae easily bored through the skin of entire tubers. A brief account of the life-history of this Bibionid is given [*cf.* *R.A.E.*, A, xx, 311, etc.]. In experiments in dipping the seed potatoes in insecticides, a 1 per cent. suspension of lead arsenate in water with the addition of 30 per cent. gypsum gave complete protection.

Rocci (U.). *Leucania* (*Sidemia*) *zeae* **Dup. (Lepid. Noct.)**—*Boll. Soc. ent. ital.*, lxv, no. 1, pp. 33–34.

Rocci (U.) & Turati (E.). *Sideridis zeae* **Dup.** (=*Leucania zeae*) **e** *Sesamia cretica* **Led. (Lepid. Noct.)**.—*T.c.*, no. 8, pp. 192–193. Genoa, January & October 1933.

Contrary to statements in the literature [*R.A.E.*, A, v, 180; vii, 157; xviii, 526], *Cirphis* (*Leucania*) *zeae*, Dup., has not yet been found in Italy. Its occurrence is certain in southern Russia and southern France, uncertain in Algeria and Spain [xix, 276], and very doubtful in Dalmatia, Greece and Egypt. The larvae feed on a variety of graminaceous plants, but only occasionally on maize. The species seriously infesting maize in Italy is *Sesamia cretica*, Led., others found occasionally being *S. vuteria*, Stoll, *Heliothis obsoleta*, F. (*armigera*, Hb.) and very rarely *Cirphis loreyi*, Dup.

Morris (H. M.). *Carpocapsa*: **Demonstrations of Methods of Control.**—*Cyprus Agric. J.*, xxviii, pt. 3, pp. 80–82, 2 refs. Nicosia, September 1933.

The treatment of two orchards in Cyprus during 1933 with one application of lead arsenate and two of lead arsenate and a proprietary white oil emulsion considerably reduced the proportion of apples attacked by *Cydia* (*Carpocapsa*) [*pomonella*, L.]. Bands of corrugated paper 3 ins. wide treated with a formula containing beta-naphthol [*R.A.E.*, A, xxi, 332] were placed on the branches of apple and pear trees just above the fork and sometimes also on the main trunk on 23rd–25th June. On examination of bands from 3 trees on 31st July and 1st August, 58, 77 and 441 larvae respectively were dead, and 13, 5 and 10 larvae and 0, 2 and 6 pupae were living.

Report on the Work of the Plant Protection Section during the Period 1925–1931.—49 pp., 1 graph. Cairo, Minist. Agric. Egypt, 1933. Price *P.T.*5.

This report includes (pp. 1–34) a review of the entomological work carried out in Egypt during the years 1925–31. The results of monthly observations on the degree of infestation of green and ripe cotton bolls by bollworms in 1928–31 are shown in tabular form. A reduction in the numbers of *Platyedra gossypiella*, Saund., caught in light-traps in cotton seed stores in Alexandria from 54,000 in 1917 to 150 in 1931 was apparently due to heat treatment. When infested bolls were buried at depths of 2–4 ins. in the soil [*cf.* xiii, 422] and wheat or berseem [*Trifolium alexandrinum*] was grown over them, more moths emerged from the soil planted with wheat. Investigations in 1929–31, however, showed that stored cotton stalks [xviii, 197] are a more serious source of infestation than buried bolls; in one area, the loss due to bollworms was 80 per cent. close to a village, and only 4 per cent. 550 yards away. Grazing by sheep or goats to destroy bolls left on the stalks is recommended. It has been found impracticable to enforce a law of 1921 [x, 167] enjoining the burning of such stalks. *Pimpla roborator*, F., was found to kill many larvae of *P. gossypiella* during the winter, but its numbers decreased so rapidly as hosts became scarce, that it was not able to exercise effective control until nearly all the crop was picked. Extensive liberations of *Microbracon kirkpatricki*, Wlkn.

[*cf.* xviii, 673] imported from the Sudan have now been made, but it is not yet known whether the parasite survives the winter.

Chrysomphalus personatus, Comst., taken at Alexandria, is recorded for the first time from Egypt.

ROMAGNOLI (M.). **Coltivazione del banano nella Somalia Italiana.** [Banana Cultivation in Italian Somaliland.]—*Agric. colon.*, xxvii, nos. 8–9, pp. 361–373, 433–446, 3 figs., 1 pl. Florence, August–September 1933.

Brief notes are given (pp. 433–434) on the bionomics of *Aspidiotus destructor*, Sign., the chief pest of bananas in Italian Somaliland. A 2 per cent. kerosene emulsion is recommended for control.

CHIAROMONTE (A.). **Considerazioni entomologiche sulla coltura delle piante da foraggio nella Somalia Italiana.** [Entomological Notes on the Cultivation of Forage Crops in Italian Somaliland.]—*Agric. colon.*, xxvii, no. 9, pp. 431–433. Florence, September 1933.

In Italian Somaliland, *Cirphis* (*Leucania*) *loreyi*, Dup., the chief pest of forage maize, is parasitised by *Apanteles ruficrus*, Hal., and *Laphygma exigua*, Hb., which attacks both forage maize and lucerne, by an undetermined Braconid. The Arctiid, *Diacrisia* (*Spilosoma*) *investigatorum*, Karsch, infests lucerne, but the injury is negligible.

TRINCHIERI (G.). **Secondo contributo alla bibliografia delle cavallette.** [Second Contribution to the Bibliography of Locusts.]—*Rass. econ. Colon.*, xxi, nos. 3–4, 5–6, pp. 369–410, 595–634, 1933. Rome, Minist. Colon., 86 pp.

This bibliography of 1,211 references forms a supplement to those contained in the author's earlier work on locust control [*R.A.E.*, A, v, 100].

MOSSOP (M. C.). **Description of Hopper Instars of the Red Locust,** *Nomadacris septemfasciata*, **Serv. Phase** *gregaria*, **and some Changes in Adult Coloration.**—*Proc. Rhod. Sci. Ass.*, xxxii, pp. 113–118, 1 ref. Salisbury, May 1933.

In the spring of 1933, *Nomadacris septemfasciata*, Serv., was observed to have six hopper instars in Southern Rhodesia ; each of these is described.

An account is given of the colour changes in adults. The hind wings assumed a purplish pink colour by June–July and by August the colours of the body darkened. Early in December 1932, the general appearance of maturing adults was dark-red, which turned to yellow by the middle of the month.

Report on Missions sent to Madagascar in Search of Parasites in Connection with the *Phytalus* **Problem in Mauritius.**—16 pp., 7 pls., 1 map. Port Louis, Mauritius, 1933.

A. Moutia gives an account of a mission to Madagascar in April–July 1932, when he investigated the factors that keep Melolonthid

larvae in check there, particularly parasitism by Scoliids and Tachinids, with a view to introducing them into Mauritius against *Lachnosterna* (*Phytalus*) *smithi*, Arrow [*cf. R.A.E.*, A, xxi, 424, etc.]. Of those observed, only *Campsomeris* (*Elis*) *pilosella*, Sauss., seemed likely to be of value. This Scoliid probably parasitises *Enaria* sp., a Melolonthid closely resembling *L. smithi* in size and occurring under climatic conditions similar to those obtaining in Mauritius. Between 25th June and 10th July, 1,008 individuals of *C. pilosella* were collected, of which 317 reached Mauritius and were liberated at various sites. The high mortality was due to the period of transit (9–10 days).

P. Regnard gives an account of a further collection of *C. pilosella* in August 1932 in northern Madagascar, and of the despatch of the parasites to Mauritius. Adults of *Campsomeris* spp. were found feeding on *Stachytarpheta indica* and *Vinca* spp.

Williams (C. B.). **The Bollworms of Cotton.**—*Emp. Cott. Gr. Rev.*, x, no. 4, pp. 273–281. London, October 1933.

A general account is given of the bionomics of *Platyedra gossypiella*, Saund., *Earias insulana*, Boisd., *Diparopsis castanea*, Hmps., and *Heliothis obsoleta*, F., and of measures for their control.

United Provinces. **Report of the Pink Boll-worm Committee.**—6 pp. Allahabad, 1933.

In April 1933, this Committee considered steps to be taken to give effect to a scheme for the control of *Platyedra gossypiella*, Saund., on cotton in the United Provinces by means of compulsory exposure of the seed at ginning factories to steam heat and of that retained in villages to the sun [*cf. R.A.E.*, A, xx, 162]. Financial and other aspects of the scheme are here discussed, and an outline of the suggested necessary legislation is given.

Mathur (R. N.). **Leaf-curl in *Zinnia elegans* at Dehra Dun.**—*Indian J. Agric. Sci.*, iii, pt. i, pp. 89–96, 2 pls., 9 refs. Calcutta, February 1933. [Recd. October 1933.]

An account is given of experiments carried out in the laboratory during 1930–31, by which it was proved that a disease of *Zinnia elegans*, characterised by curling of the leaf-blades and thickening of the small veins on the lower surface, is transmitted by *Bemisia gossypiperda*, Misra & Lamba, and is similar to leaf-curl of cotton in the Sudan [*R.A.E.*, A, xxi, 582 ; etc.]. In older plants, the symptoms are often practically confined to the lateral shoots or a few older leaves. In young plants, growth is stunted (often not exceeding 1 ft.), though they may continue to live for some months ; the leaves turn bronze, shrivel and fall, the younger ones at the growing points being first affected. During the summer and rains, the axillary buds develop into stunted shoots with small, crinkled leaves, frequently massed together in rosette or bunchy form. In winter, the development of the disease is retarded. The period of growth of *Zinnia* is June–November, and the maximum incidence of the disease occurs from July to September, coinciding with the period of greatest abundance of the Aleurodid. *Z. elegans* has not previously been recorded as a food-plant, but no others have yet been observed at Dehra Dun.

The technique employed in transmission experiments is described. When whiteflies were collected from diseased plants growing in a cage in the insectary and transferred to healthy ones grown from seed under controlled conditions, the latter contracted the disease in 6–25 days and were as severely infected by the feeding of a single individual as by large numbers. Newly emerged adults that had fed as nymphs on diseased plants failed to transmit the disease [*cf.* xix, 709].

TAN (Chia-chen). **Notes on the Biology of the Lady-bird Beetle,** *Ptychanatis axyridis*, **Pall.**—*Peking Nat. Hist. Bull.*, viii, pt. 1, pp. 9–18, 1 pl., 6 refs. Peiping, September 1933.

An account is given of laboratory observations in China on the bionomics of *Coccinella* (*Ptychanatis*) *axiridis*, Pall., which is predacious on Aphids [*cf. R.A.E.*, A, vii, 153 ; etc.]. All stages are described. The eggs were laid in irregular masses, which contained on an average 16–20 ; under natural conditions, they were usually found on the lower surface of leaves infested with Aphids. The mortality of the eggs was usually 10–30 per cent. The incubation period was 2–3 days at 25–30°C. [77–104°F.], and about a week at 20°C. [68°F.]. Eggs submerged in water for 5 minutes hatched normally. The four larval instars occupied an average total of 11–12 days at 25–30°C., but were prolonged at lower temperatures. The pupal period lasted 2–7 days in summer, but as long as 24 days at lower temperatures. Both adults and larvae were found on the leaves of plants, feeding exclusively on Aphids, but in an experiment 2 out of 20 beetles completed their life-cycles when fed entirely on eggs and larvae of their own species.

The adults were positively phototropic and negatively geotropic. Pairing took place 5–6 days after emergence, and oviposition 2–5 days later. Pairing continued throughout the life of the female. Unfertilised females laid sterile eggs. One female observed laid 498 eggs in 24 batches when isolated with a single male. The length of adult life varied greatly ; one female lived for 142 days after emerging from hibernation. Swarming flights prior to hibernation usually took place in October in bright sunshine. Autumn experiments showed that low temperature (below about 15°C. [59°F.]) had more influence on hibernation than lack of food.

VAN DER MEER MOHR (J. C.). **Entomologische aanteekeningen III.** —*Meded. Deli Proefst.*, (2) lxxxv, pp. 1–12, 2 pls. Medan, 1933. (With Summaries in English.)

Polanisia viscosa, which is sometimes cultivated, is one of the few food-plants in Deli, Sumatra, of *Engytatus tenuis*, Reut., a pest of tobacco. *Sesamum indicum* has also been found liable to attack by this Capsid in Deli [*cf. R.A.E.*, A, xv, 506].

CUNNINGHAM (G. H.) & MUGGERIDGE (J.). **Orchard Sprays in New Zealand. V. The Oil Series.**—*N.Z. J. Agric.*, xlvii, nos. 1–2, pp. 8–18, 89–96, 35 refs. Wellington [N.Z.], 1933.

In this paper, which is one of a series [*cf. R.A.E.*, A, xxi, 409], the development of oil spraying is discussed. The composition of tar oils and petroleum oils, and the physical and chemical properties of the latter that should be used in specifications for insecticidal oils

are described. Further sections deal with emulsifiers and emulsions, the effects of oil sprays on insects and plants, and general recommendations on their use.

HUSTACHE (A.). **Deux nouveaux curculionides déprédateurs.**—*Bull. Mus. Hist. nat.*, (2) v, no. 5, pp. 376–380, 1 ref. Paris, June 1933.

The weevils described are *Solanophagus vorax*, gen. et sp. n., which infests potatoes in Colombia and Ecuador, the adults and larvae living in the tubers, and *Batatarhynchus destructor*, gen. et sp. n., which attacks sweet potato in New Caledonia.

MONTE (O.). *Hypsipyla grandella* **Zeller, uma praga da silvicultura (Lep. Phycitidae).** [*H. grandella*, a Pest of Forestry.]—*Rev. Ent.*, iii, no. 3, pp. 281–285, 1 fig. Rio de Janeiro, 25th September 1933.

Cedrela fissilis, a forest tree of considerable value for its timber and medicinal bark, is attacked in the State of Minas Geraes by the Pyralid, *Hypsipyla grandella*, Zell., the larvae of which bore into the cones and completely destroy the seeds, so that re-afforestation by seed is impossible. The adult oviposits on the unripe cone, and the larva pupates within it. It is suggested that the fruits should be picked and destroyed towards the end of April, when pupation is taking place.

PICKLES (A.). **Entomological Contributions to the Study of the Sugar-cane Froghopper.**—*Trop. Agriculture*, x, nos. 9–10, pp. 240–245, 286–295, 4 figs., 17 refs. Trinidad, 1933.

This paper, the second of a series on the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] in Trinidad [*cf. R.A.E.*, A, xxi, 519], deals with the factors that limit the incidence of froghopper blight in plant canes. In three sugar estates examined in 1931, the percentage of severely blighted fields of plant cane was only 7, as compared with 23 of ratoon fields [*cf.* xv, 389, 390]. In experiments in which 25 froghoppers were introduced daily for 10 days into each of 8 cages, 4 on plant canes and 4 on second ratoons, the average number of blight marks on a leaf of the former was 1·82 and of the latter 1·36, suggesting that there is no significant difference in physiological resistance. It is possible that the difference in blight incidence may be connected with the preference of the froghoppers for unhealthy canes [xiv, 619], or that it may be due to different microclimatic conditions, dependent on plant growth.

Of two fields of plant canes invaded by second-brood adults in 1932, it was found that third-brood nymphs were about 200 times and eggs about 20 times as numerous in one, where the canes were tall and dense, as in the other, where they were only 3 ft. high and sparse. Counts of eggs in soil samples in 1931 also showed that, whereas young plant canes are relatively unattractive to ovipositing females, older ones are apparently almost as attractive as ratoons. Even in ratoons, small canes seemed to be avoided. It is thus probable that the degree of infestation is more influenced by the effects of the stature and general growth characteristics of the plants on micro-climate and on

the tropisms of the froghoppers than by any food preference on the part of the latter.

Data are given showing that the number of eggs in the trash, particularly toward the end of the year, is small [xx, 94], so that factors influencing the survival of froghopper populations from one wet season to the next will operate chiefly on eggs in the soil. Experiments to determine the distribution of the latter in both the vertical and horizontal planes are described, and detailed figures illustrate the methods used. It was found that cultural measures, such as ploughing, chiselling and to a less extent forking, are beneficial, in that they disperse the eggs from their original concentration round the stools, an effect that does not result from the usual treatment of ratoon fields. The eggs did not appear to be buried beneath a deep layer of soil by any tillage operations studied.

Occasional infestations of plant cane fields were found to be due to invasion from external breeding grounds, survival of ratoon stools in fields of plant canes, and abnormal abundance of froghoppers in certain years.

Work connected with Insect and Fungus Pests and their Control.—*Rep. Agric. Dept. St. Kitts-Nevis 1932*, pp. 2–3, 29. [Trinidad] 1933.

In 1932, an average of 20·6 per cent. of the joints of sugar-cane from various estates in St. Kitts were infested with *Diatraea saccharalis*, F. [*cf. R.A.E.*, A, xx, 708]. Consignments of *Lixophaga diatraeae*, Towns., were obtained from Cuba [*cf.* xxi, 162], and artificial rearing was carried out. Small colonies of the Tachinid were distributed practically throughout the Island, and there is some evidence that it has become established. Sugar-cane was also damaged by the weevil borer, *Metamasius hemipterus*, L., attacks by which appear to be chiefly secondary to those by *Diatraea*. *Platyedra* (*Pectinophora*) *gossypiella*, Saund., caused severe damage to cotton in Nevis and in some districts in St. Kitts, infestation beginning soon after flowering. Cotton stainers [*Dysdercus*] are increasing in Nevis and were fairly abundant towards the end of the picking season.

Rodríguez (J. P.). **El cultivo del algodón Sea Island en Puerto Rico.** [The Cultivation of Sea Island Cotton in Porto Rico.]—*Circ. P.R. Estac. exp. insul., Rio Piedras*, no. 102, 33 pp., 13 figs., 1 map, 14 refs. S. Juan, P.R., 1933.

Of the pests of cotton in Porto Rico [*cf. R.A.E.*, A, xix, 694], the chief is *Platyedra* (*Pectinophora*) *gossypiella*, Saund., which increased in 1930–31 to such an extent as to cause serious losses [*R.A.E.*, A, xx, 401]. In 1931, 20 per cent. of the larvae in the south-coast districts survived in a resting stage from April to October or May to November. The old fields should therefore be cleared of bolls, the dates of sowing and harvesting restricted, seed fumigated and wild cotton plants destroyed. Against *Alabama argillacea*, Hb., the most important pest of the leaves, a lead arsenate spray should be applied at the first sign of infestation. *Dysdercus andreae*, L., and *D. sanguinarius*, Stål (*neglectus*, Uhl.), which sometimes cause serious damage, should be shaken from the branches into trays containing water and kerosene.

KEIFER (H. H.). **Some Pacific Coast Otiorhynchid Weevil Larvae.**—*Ent. amer.*, (N.S.) xiii (1932), no. 2, pp. 45–84, 6 pls., 6 refs Lancaster, Pa., 1st November 1933.

Descriptions are given of the larvae of some weevils occurring in the Pacific Coast region of the United States, including *Dyslobus decoratus*, Lec., *D. ursinus*, Horn, *D. granulatus*, Casey, *Otiorrhynchus* (*Brachyrrhinus*) *ovatus*, L., and *O.* (*B.*) *rugosostriatus*, Goeze, all of which are recorded as attacking strawberry, and *O.* (*B.*) *sulcatus*, F., *O.* (*B.*) *meridionalis*, Gyll., *O.* (*B.*) *cribricollis*, Gyll., and *Pantomorus godmani*, Crotch.

ROBINSON (R. H.) & CHILDS (L.). **Oil Spray Recommendations.**—*Sta. Circ. Oregon Agric. Expt. Sta.*, no. 107, 8 pp. Corvallis, Ore., January 1933. [Recd. October 1933.]

This guide to the uses of mineral oils for dormant and summer sprays, particularly on apples and pears, is largely based on experimental work carried out for the past six years in various parts of western North America. It includes details of the preparation of a stock emulsion with casein-ammonia [*R.A.E.*, A, xxi, 608] and of tank-mixture sprays [*cf.* xx, 586].

MILLER (J. M.). **A Record of Winter Kill of Western Pine Beetle in California, 1932.**—*J. For.*, xxxi, no. 4, pp. 443–446, 1 ref. Washington, D.C., April 1933.

Examination in December 1932 of 133 samples of bark from an area of valuable commercial timber covering 45,000 acres in north-eastern California revealed that three days of exceptionally cold weather [*R.A.E.*, A, xxi, 593], when the maximum and minimum temperatures were 12 and −19°F., had caused the death of 65 per cent. of the broods of the western pine beetle [*Dendroctonus brevicomis*, Lec.] and also of an appreciable number of other species present, such as the mountain pine beetle [*D. monticolae*, Hopk.], flathead [Buprestid] borers and predacious Clerids. *D. brevicomis* was most susceptible in the last larval instar, and the mortality was greatest in trees having thin or loose bark; in felled trees, it was highest towards the top of the tree. It was expected that the surviving population would be considerably reduced in the 4–5 months before emergence by such agencies as bird and insect predators and a bacterial disease that affects the larvae.

In two other areas, average mortalities of about 28 and 65 per cent. and maxima of 75 and 100 per cent., respectively, were recorded; in central California, air temperatures were probably not low enough to produce lethal temperatures in the bark [*cf.* xx, 14].

The Progress in Forest Entomology and Protection Against Forest Insects.—*A National Plan for American Forestry*, Senate Docum., no. 12, pp. 723–732, 1415–1418, 2 refs. Washington, D.C., 1933.

This report, prepared by the Forest Service, U.S. Department of Agriculture, comprises a general outline of the situation in forest areas in the western United States with regard to the damage caused by the principal insect pests and of the development and organisation of measures for its prevention or control.

SCOTT (L. B.) & PATCH (L. H.). **The Survival of European Corn-borer Larvae in Barns and other Storage Places.**—*Circ. U.S. Dept. Agric.*, no. 281, 6 pp., 3 refs. Washington, D.C., August 1933.

With a view to determining whether the larvae of the European corn borer [*Pyrausta nubilalis*, Hb.] are able to survive the winter in various types of farm buildings used for storage of dry maize stalks, experiments were carried out in the winters of 1926–1930 in New York and Ohio with infested material stored in different shelters. The percentages of larvae that developed into moths were: 0 in a warm, dry room of a house; 7·3 in a dry barn loft; 39·7 in a barn in which the stalks were stored over a damp earthen floor but not in contact with the earth; and 56·2 in an open shed. About half the moths that emerged from the stalks stored on the earthen floor and 94 per cent. in the open shed appeared before 15th August and would probably have given rise to another generation. It is recommended that infested stalks should be disposed of before emergence begins, unless they have been stored in shelters in which temperature and moisture conditions are similar to those obtaining in the loft of a very dry barn.

PARKER (J. R.). **Fight Grasshoppers by plowing Stubble.**—*Circ. U.S. Dept. Agric.*, no. 302, 4 pp., 3 figs. Washington, D.C., September 1933.

In the Great Plains area of the northern United States, the eggs of *Melanoplus differentialis*, Thomas, and *M. bivittatus*, Say, are laid in cultivated fields only when they contain weeds or clumps of grass, and are usually concentrated in large numbers in land bordering the crops, where they may be destroyed by ploughing in a narrow strip. Several applications of poisoned bran mash distributed round the edges of the field, the first as soon as it is attacked, generally save the crop. Eggs of *M. mexicanus*, Sauss. (migratory grasshopper), on the other hand, are scattered throughout the fields, preferably those of late flax, barley and oats, though fields left unharvested owing to damage early in the summer by drought or invasion by grasshoppers and in which weeds have appeared are very attractive. During 1931–32, the first two species, together with *Camnula pellucida*, Scudd., which also oviposits in sod land, were responsible for at least 90 per cent. of the damage, but owing to extensive migrations in July and the first half of August 1933, *M. mexicanus*, which hatched in large numbers under extremely favourable conditions, now predominates throughout North Dakota, a large part of South Dakota and across northern Montana to the Rocky Mountains.

The prospect of damage to crops in 1934 is extremely serious, but the cost of control could be very greatly reduced by ploughing all stubble lands (preferably with a mouldboard plough) to a depth of 4–6 ins. in autumn or early spring before hatching occurs about 15th May. Compacting the soil by harrowing or other methods would improve the results. Experiments have shown that the newly-hatched hoppers are unable to penetrate more than 3 ins. of fairly compact earth. Where ploughing is inadvisable owing to soil drifting, the eggs may be brought to the surface (where they will be destroyed by desiccation) by shallow cultivation with a disk harrow, preferably during dry, hot weather. Repeated diskings bring additional eggs

to the surface, but complete control cannot be obtained in this way at a reasonable cost.

Farmers are warned against drilling the seed into the previous year's stubble, which in 1933 resulted in the complete destruction of the crops by grasshoppers or in excessive expenditure for their protection.

KNOWLTON (G. F.). **Notes on injurious Utah Insects.**—*Proc. Utah Acad. Sci.*, x, pp. 153, 159–162, 4 refs. Salt Lake City, 1933.

Considerable seasonal fluctuations observed in the numbers of the potato Psyllid [*Paratrioza cockerelli*, Sulc] in Utah [*cf. R.A.E.*, A, xix, 556] are believed to be due more to climatic conditions than to the activity of predacious insects, which include *Nabis ferus*, L., and *Geocoris decoratus*, Uhl. In the field, heat and drought appear markedly to retard normal reproductive activity [*cf.* xxi, 455], and the winter is passed in hibernation; in the laboratory, reproduction continued rapidly in winter or summer at temperatures similar to those occurring in the field in autumn or spring, but decreased under noticeably hot or cold conditions. A spray of pyrethrum (with or without soap) or nicotine or a calcium cyanide dust killed the nymphs, but their position on the lower surface of the leaves made complete control difficult. It was also found that free water reaching the hibernating adults causes a high mortality. Matrimony vine [*Lycium*] appears to be an important spring food-plant of the Psyllid, and on it an early generation may mature before potatoes or tomatos are available. Several adults of *P. cockerelli* emerged in early spring from galls of *Pachypsylla venusta*, O.S., on hackberry [*Celtis*], where they had probably taken shelter. An apparently new parasite, *Amblymerus* sp., and a hyperparasite of it, *Habrocytus onerati*, Fitch, were reared from the galls of *P. venusta*.

Among the more important insect pests observed in Utah in 1932 were: *Erythroneura comes*, Say, which became extremely abundant in late summer on vines and Virginia creeper in the north; the Pentatomid, *Chlorochroa sayi*, Stål, which caused serious damage to wheat in a number of localities; *Nysius ericae*, Schill., which was very abundant on Russian thistle [*Salsola kali*] and other weeds in many places before migrating to wheat and vegetable crops; *Hypera* (*Phytonomus*) *variabilis*, Hbst. (*posticus*, Gyll.), which caused more damage to lucerne during 1931 and 1932 than in several preceding seasons; *Protoparce sexta*, Joh., *P. quinquemaculata*, Haw., and *Celerio lineata*, F., which attacked potatoes and tomatos; and *Plutella maculipennis*, Curt., which in some localities was unusually abundant on mustard in spring. Grasshoppers on lucerne and other crops and *Eutettix tenella*, Baker, on sugar-beet and tomatos were considerably less injurious than in 1931. An adult male Stylopid, *Agalliaphagus* sp., was found emerging from an individual of *E. tenella*, and of 850 examples of *Erythroneura comes*, one was attacked by an internal parasite, apparently a larva of *Pipunculus* sp.

HASEMAN (L.) & JOHNSON (P. H.). **Entomology.**—*Bull. Agric. Expt. Sta. Missouri*, no. 328, pp. 27–30, 1 fig. Columbia, Mo., July 1933.

Information is given on the methods by which the seasonal activity of the codling moth [*Cydia pomonella*, L.] is followed in Missouri

[*cf. R.A.E.*, A, xx, 637]. Hopkins' bioclimatic law [viii, 87] seems applicable in general to this species, though variation in local winter conditions affected emergence. By correct timing of spray applications and increasing the amount of lead arsenate in 50 U.S. gals. spray from 1 lb. to 1½–2 lb., the percentage of damaged apples at harvest may often be reduced to 8–10. In an investigation of the supposed development of a greater resistance to arsenic in some localities, [*cf. R.A.E.*, A, xvii, 365, 722 ; xviii, 307 ; xx, 19, etc.], larvae from Colorado, Virginia and Missouri were found to be all equally susceptible.

Encouraging results against the tarnished plant bug [*Lygus pratensis*, L.] damaging strawberries [*cf.* xvi, 400] were obtained with a spray of 4 oz. potash vegetable oil soap and 1 U.S. gal. water, which appeared to be improved by the addition of 40 per cent. nicotine sulphate (1–1600). Spraying with 2 lb. lead arsenate and 50 U.S. gals. water [*cf.* xviii, 572] proved considerably more satisfactory against the strawberry crown-borer [*Tyloderma fragariae*, Riley] in one locality than dusting with 1 lb. lead arsenate and 5 lb. hydrated lime. Dusts of barium fluosilicate and synthetic cryolite protected cucurbits from infestation by the striped and spotted cucumber beetles [*Diabrotica melanocephala*, F., and *D. duodecimpunctata*, F.]. Arsenicals and barium fluosilicate have proved the most economical for the control of the former species, the numbers of which the following summer may be materially reduced by ploughing in the vines and green fruits at harvest and destroying leaves and rubbish [*cf.* xix, 491]. Blister beetles [*Epicauta*] were driven within 3 hours from late potatoes dusted with barium fluosilicate and calcium arsenate, but re-infested the plants after the insecticides had been removed by rain. Owing to the abundance during the autumn of 1931 of grasshopper eggs, on which their larvae feed, the number of these beetles was materially increased during 1932.

Rain practically eliminated the early spring generation of chinch bugs [*Blissus leucopterus*, Say] in some regions. Large numbers of harlequin cabbage bug [*Murgantia histrionica*, Hahn] survived the mild winter [*cf.* xxi, 239], and this Pentatomid is now a serious pest of cruciferous crops. Melons should not be grown adjacent to cotton, as both are attacked by the melon aphis [*Aphis gossypii*, Glov.] ; when infestation is first observed, the infested hills should be treated with nicotine or covered with earth.

Davis (J. J.). **Insects of Indiana for 1932.**—*Proc. Indiana Acad. Sci.*, xlii (1932), pp. 213–225. Indianapolis, Ind., 1933.

Brief notes are given on a considerable number of insect pests recorded in Indiana in 1932. Less usual ones include : *Anuraphis* (*Aphis*) *maidiradicis*, Forbes, damaging maize during June and July ; the Limacodid, *Sibine stimulea*, Clem., feeding on plum foliage and maize in August ; the Noctuid, *Ceramica* (*Mamestra*) *picta*, Harr., on cauliflower in June ; *Epitrix fuscula*, Crotch, on egg-plants [*Solanum melongena*] ; the Notodontid, *Schizura concinna*, S. & A., on apple in mid-July ; the Siricid, *Tremex columba*, L., ovipositing in pear trees in late September ; the Aegeriid, *Podosesia syringae*, Harr., on lilac ; the Saturniid, *Automeris io*, F., attacking *Gladiolus* in August ; the Tingid, *Corythucha marmorata*, Uhl., on chrysanthemums in August ; and the Cerambycid, *Eburia quadrigeminata*, Say, in flooring timber in July.

Clausen (C. P.). **Insect Enemies of Insects and their Relation to Agriculture.**—*Rep. Smithson. Inst. 1932*, pp. 353–362 (Publ. 3202). Washington, D.C., 1933.

This is a general discussion of the importance of parasites and predators in checking outbreaks of insect pests. The habits of some parasites are briefly discussed, with special reference to those that have an involved relation to other insects, on which they depend to reach their hosts, and the rate of reproduction necessary to maintain them. The author stresses the need of introducing into the United States the natural enemies of introduced pests, which probably constitute more than half of the more important agricultural pests in that country. Although biological control, when successful, has the great advantage that the initial cost is the total cost, it is seldom so effective that other measures can be completely discontinued. Instances are discussed of the successful establishment of the natural enemies of important crop pests in the United States, Cuba and Hawaii.

The Influence of Civilisation on the Insect Fauna of North America.—*Ann. Ent. Soc. Amer.*, xxvi, no. 3, pp. 497–528, 22 refs. Columbus, Ohio, September 1933.

Under this heading are included four papers dealing with the influence of civilisation on the insect fauna of forests, and in regions of industrial activity, in cultivated areas and where deliberate introductions of foreign species have been made. They include many details of interest for which the original should be consulted.

In the first (pp. 497–503), S. A. Graham states that adequate discussion of the present situation will only be possible when a sufficient amount of quantitative data has been accumulated concerning insect populations, the biotic potential of many species, and the quantitative effects of environmental resistance. Chapman's definition of the term biotic potential [*R.A.E.*, A, xv, 547] is amplified by the addition of the factors of time and optimum environmental conditions ; the term environmental resistance is used to express the difference between the potential number of individuals of a species and that actually produced in a given time, from which, by expressing the known influencing factors as numerical units, the extent of those unknown may be measured and the fluctuations in population and the underlying causes may be studied. Brief examples are cited of the changes in insect populations in forests due to the accidental introduction of foreign insects and also to the alteration of the components of forests owing to forestry operations.

In the second paper (pp. 503–510), P. W. Claassen points out that industries concerned with smelting adversely affect insect populations by the discharge of poisonous gases, whereas those dealing in woollen goods or in milling encourage the development of certain injurious insects, and others, such as centralised market garden industries, are instrumental in the introduction of pests from abroad, any imported commodity in which insects may shelter being at least a potential danger. The pollution of lakes and streams with the waste materials of factories, particularly milk and salt, causes great changes in the aquatic fauna and in some cases the elimination of all forms of life. Biological examination affords one of the most reliable methods of evaluating a stream and determining the effect of industrial wastes

on the organisms in it ; a study of the insect fauna, particularly, reveals the degree of pollution and the period for which it has occurred.

In the third (pp. 510–518), R. C. Smith shows, with reference to the literature, that though civilisation has checked the development of some insects by artificial measures and prevented their spread by the erection of mechanical and artificial barriers, it has resulted in the increase of others owing to the partial replacement of the primitive flora by the extensive cultivation of a few particular crops. By means of transport, new species, including those obtained intentionally for beneficial purposes, have been introduced, and by the breeding of different strains of plants new physiological strains or varieties of insects have been produced.

In the fourth (pp. 518–528), H. S. Smith expresses the view that the establishment of exotic species of entomophagous insects affects population densities chiefly through the destruction of the host and the ensuing change in the biological association, and also through competition with native forms. The average number of individuals that can occupy a given habitat remains the same whether one or more species are concerned, provided that their habits and intrinsic qualifications are the same. However, should one have superior intrinsic qualifications, it will tend to eliminate the other and increase the total number of individuals occupying the habitat ; thus, native species are often ousted by the introduced ones, which are free from attack by indigenous natural enemies. Accurate data on the quantitative effect of the addition of species to the fauna are largely lacking, but certain instances from California in which the alteration has been so marked as to attract general notice are discussed. It is pointed out that the most efficient entomophagous species are those sufficiently distinct from the native ones to be free from attack by the natural enemies of the latter and those capable of operating effectively when the host population is low. The effect of the introduction into the United States of parasites of the gipsy moth [*Porthetria dispar*, L.] and of the alfalfa weevil [*Hypera variabilis*, Hbst.] is briefly discussed, largely from the literature.

Folsom (J. W.). **The economic Importance of Collembola.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 934–939, 35 refs. Geneva, N.Y., October 1933.

The most serious types of damage caused by Collembola are described from the literature, and a list of all the known injurious species is given. The presence of these springtails is often overlooked on account of their small size, and the damage occasioned by them is attributed to other causes. Under favourable conditions of humidity and temperature, they increase rapidly to immense numbers, but they soon dry up in a dry atmosphere and can resist high temperatures only in the egg-stage. Most springtails are phytophagous, and the organic matter that forms their food is obtained from many different sources. The greatest damage is done to young, tender plants, some species confining themselves to one or other surface of the leaves. Irregular holes are made into or through the leaves, and feeding occurs at wounds made by other insects, cotyledons and other leaves being sometimes completely destroyed. Feeding may be collective, several individuals co-operating to enlarge the same opening. In some instances, the stems of plants are injured just below the surface of the ground or even cut through.

Root hairs and small rootlets may also be destroyed. On seeds, pits are eaten out, and on bulbs the interior is sometimes completely excavated. Injury is caused to vegetables and similar crops in the United States, Canada and Britain by *Bourletiella hortensis*, Fitch [*cf. R.A.E.*, A, xiv, 619 ; etc.] ; to field crops in South Australia by *Smynthurus viridis*, L. [xxi, 406, etc.] ; to sugar-cane in Louisiana by *Pseudosinella* (*Lepidocyrtus*) *violenta*, Fols., *Onychiurus armatus*, Tull., and possibly *Proisotoma minuta*, Tull. [xviii, 168 ; xix, 615], and in Hawaii by *Isotomodes* sp. [xx, 304] ; and to mushrooms in the United States by *Achorutes armatus*, Nic. [xx, 302], and also by other species of *Achorutes*, *Xenylla*, *Schöttella* and *Isotoma*, in conjunction with *Lepidocyrtus cyaneus*, Tull., and *Sinella höfti*, Schäf.

GAINES (R. C.). **Progress Report on the Development of the Boll Weevil on Plants other than Cotton.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 940–943, 1 pl., 4 refs. Geneva, N.Y., October 1933.

Records of food-plants of *Anthonomus grandis*, Boh., and *A. grandis thurberiae*, Pierce, other than cotton are reviewed from the literature [*R.A.E.*, A, ii, 582 ; iv, 267, etc.]. In order to determine whether the elimination of cotton would result in the extermination of *A. grandis*, tests were carried out in Louisiana in 1932, in which hibernated weevils that had emerged from cotton squares placed in breeding cages or had been collected from the field were confined with 5 species of malvaceous plants. They fed freely on buds and blooms of *Hibiscus syriacus* and on buds, blooms and seed-pods of *H. militaris*, and less freely on blooms and seed-pods of *H. lasiocarpus*. They fed sparingly on buds and seed-pods of hollyhock (*Althaea rosea*) and were not observed to feed on okra (*H. esculentus*). Some larvae hatched from eggs deposited externally on calyces or seed-pods of *H. militaris* and *H. lasiocarpus*, but died, apparently without feeding. No eggs were deposited on hollyhock or okra. Three females developed from eggs laid normally in buds of *H. syriacus*.

EWING (K. P.) & MCGARR (R. L.). **The Effect of certain Homopterous Insects as compared with three common Mirids upon the Growth and Fruiting of Cotton Plants.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 943–953, 3 pls., 3 refs. Geneva, N.Y., October 1933.

Since it has been recently shown that several species of Capsids cause damage to cotton [*R.A.E.*, A, xviii, 64 ; *cf.* also xx, 404], cage experiments were conducted in Louisiana in 1929–31 with the Jassids, *Homalodisca triquetra*, F., *Oncometopia undata*, F., and *Graphocephala versuta*, Say, and the Membracid, *Stictocephala festina*, Say, all of which were abundant on cotton during the growing season. None caused appreciable injury to cotton, and plants exposed to them were able to mature a full crop, whereas the Capsids, *Psallus seriatus*, Reut., *Lygus pratensis*, L., and *Adelphocoris rapidus*, Say, severely injured the cotton, generally causing the loss of almost all the fruit.

MCGARR (R. L.). **Damage to the Cotton Plant caused by *Megalopsallus atriplicis* Kngt. and other Species of Miridae.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 953–956, 3 refs. Geneva, N.Y., October 1933.

In experiments in Texas in 1930, *Megalopsallus atriplicis*, Knight, a Capsid commonly found on *Atriplex matamorensis*, when allowed to

feed upon cotton, caused blasting of the young squares, swellings and lesions on the stems and petioles and malformations of the leaves similar to those produced by *Psallus seriatus*, Reut. Six other Capsids that do not usually occur on cotton also caused swellings and lesions on the stems and petioles.

CAINES (J. C.). **Factors influencing the Activities of the Cotton Bollworm Moth** (*Heliothis obsoleta* **Fab.**).—*J. Econ. Ent.*, xxvi, no. 5, pp. 957–962, 6 graphs, 3 refs. Geneva, N.Y., October 1933.

Observations of adults of *Heliothis obsoleta*, F., on cotton in Texas with a wheeled trap were continued in 1932 [*cf. R.A.E.*, A, xx, 630]. No marked moths (released between 4th July and 28th August) were recaptured. While the first generation was in the cotton, the moths rested during the day, but at night they visited a large number of cotton plants to feed and oviposit, sometimes flying considerable distances (over 100 yards). Throughout the season, males were slightly in the majority ; during the first week of each generation, they were twice as numerous as females. The trap was pushed three times a week over 1 acre each of small and rank cotton, and estimates of the growth of the cotton, the number of fruits per plant and the number of eggs per acre were made at weekly intervals. The moths being scarce and probably all of local origin, there was a close correlation between the average plant heights, the number of fruits per plant and the average number of moths and eggs per acre [*cf. loc. cit.*]. When growth ceased (about 25th July in the small cotton and 15th August in the rank cotton), the incidence of moths and eggs began to decrease.

GAINES (J. C.). **A Study of the Cotton Flea Hopper with special Reference to the Spring Emergence, Dispersal and Population.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 963–971, 2 figs., 4 graphs. Geneva, N.Y., October 1933.

The results of observations carried out in 1930–32 on *Psallus seriatus*, Reut., on cotton in Texas are summarised. Early in the season (in April–May), the fleahoppers migrate from miscellaneous weeds, including *Monarda* sp., to cotton ; in July or August, they migrate to goatweed (*Croton capitatus*), on which most of the eggs that overwinter are deposited [*cf. R.A.E.*, A, xiv, 630, 631]. Records were made of the nymphs hatching from overwintered eggs on plants of *C. capitatus*, which were placed in cages about 1st February, and of adults caught in screen traps [xxi, 258] and by sweeps with the net in both weeds and cotton fields from early spring till late autumn. There were two peaks of infestation on *C. capitatus* (June and September in 1931, late July and September–October in 1932) and also on cotton (May and August in 1931, July and September–October in 1932). Rainfall, by stimulating the growth of the food-plants, increased infestation. After a wet autumn, more nymphs hatched in spring, and this, together with the time of hatching and dispersal, affected the infestation of cotton.

The numbers caught on a trap 9 ft. high seemed to be about the same at different heights during the summer months, but were greatest on the highest portion in April–May and again in October, showing that the adults fly high and spread over long distances during the dispersal periods. Cotton 10–25 miles from fields of *C. capitatus* is often heavily infested in spring.

HINDS (W. E.) & OSTERBERGER (B. A.). **Sugarcane Borer Effect upon Value of Seed Cane. A preliminary Report.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 972–973. Geneva, N.Y., October 1933.

An abstract is given of a report on studies carried out in Louisiana, to determine the effect of infestation of seed cane by the sugar-cane borer [*Diatraea saccharalis*, F.] upon the resulting stands and yields during the following season. After preliminary experiments in 1928–29, detailed studies were conducted in 1931–32. Very lightly, moderately, and heavily, infested samples of six varieties were planted. In February, it was evident that fewer eyes had germinated in the more heavily infested plots. The loss in yield ranged up to 8·5 tons per acre from the most susceptible variety ; in the three varieties of medium-vigorous growth, it was over 4 tons per acre, and in the three of more vigorous growth practically 2½ tons, or averages of 17·5 and 7·1 per cent. respectively of the yield of plots planted with uninfested cane of the same varieties.

LYLE (C.). **Sugarcane Beetle Injury to Greenhouse Roses.**—*J. Econ. Ent.*, xxvi, no. 5, p. 973. Geneva, N.Y., October 1933.

The observation was made in Mississippi early in September 1932 that of 12,000 roses in a greenhouse, about 67 per cent. had been attacked, apparently 3–4 weeks earlier, by adults of *Euetheola rugiceps*, Lec., most of the beetles having then disappeared. The bark had been gnawed just below the soil, and some plants were almost cut in two, but many eventually recovered. Eggs or young larvae of the Dynastid had apparently been introduced in the soil taken from a strip along a small ditch through pasture containing a thick sod of various grasses.

HOLLOWAY (T. E.). **A Method of Avoiding the Destruction of *Trichogramma* in Sugarcane Fields.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 974–977, 9 refs. Geneva, N.Y., October 1933.

Attention is called to experiments started 20 years ago in Louisiana on the conservation of sugar-cane trash as a method of avoiding the destruction of *Trichogramma minutum*, Riley [*R.A.E.*, A, iv, 115 ; xvi, 463, etc.], adults of which are believed to hibernate there. Besides the probable reduction in infestation by *Diatraea saccharalis*, F., this practice makes it possible to plough in the trash [*cf.* vii, 408], thus conserving the surplus available nitrogen in the soil and increasing the availability of phosphorus by 15–20 lb. per acre during the earlier stages of decomposition.

KNOWLTON (G. F.). **Aphis Lion Predators of the Potato Psyllid.**—*J. Econ. Ent.*, xxvi, no. 5, p. 977. Geneva, N.Y., October 1933.

In an experiment in Utah, a half-grown larva of *Chrysopa* sp., when placed in a glass vial with 14 adults of *Paratrioza cockerelli*, Sulc, killed 5 within 46 minutes. Another killed 9 nymphs of *P. cockerelli* within 35 minutes.

FELT (E. P.). **Beech injured by Borers.**—*J. Econ. Ent.*, xxvi, no. 5, p. 977. Geneva, N.Y., October 1933.

Xylotrechus quadrimaculatus, Hald., is recorded as attacking beech in Massachusetts and Connecticut, boring into and pruning off branches

of up to 2 inches in diameter. This Cerambycid appears to be of local occurrence, and in the course of a few years may become sufficiently numerous to mutilate trees of considerable size. The eggs are laid in crevices in the bark and in healed injuries in the branches in late May or the first half of June. As the borers hibernate in the branches, systematic pruning and burning should give effective control.

A Buprestid, probably *Agrilus bilineatus*, Web., has been observed boring in beech limbs in Connecticut and Delaware, killing individual branches and destroying the symmetry of the trees.

FLETCHER (R. K.). **Experiments in the Control of the Corn Earworm, *Heliothis obsoleta* (Fabr.), with *Trichogramma minutum* Riley.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 978–982. Geneva, N.Y., October 1933.

In maize fields under observation in Texas in 1931, 95 per cent. of the ears were damaged by *Heliothis obsoleta*, F. Sometimes as many as 50 per cent. of the eggs deposited on the silks of late maize are parasitised by *Trichogramma minutum*, Riley, but the parasite is much less abundant earlier in the season. Studies in its dispersion were therefore carried out in 1931, parasitised eggs of *Sitotroga cerealella*, Ol., being placed in gelatine capsules, which were pinned to the lower surface of maize leaves, but no increase in parasitism was observed. In 1932, a definite attempt was made to control *H. obsoleta* by releasing numbers of the parasite (6,000 to the acre in late May and early June in one experiment and 10,000 in June-July in another), but no significant reduction in infestation was obtained.

BUTLER (H. G.). **Larval Parasites of the Oriental Fruit Moth in Roane County, Tennessee.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 982–987. Geneva, N.Y., October 1933.

The practical impossibility of maintaining an effective covering of insecticide over the rapidly growing twig terminals in peach orchards during spring and early summer permits the development of two broods of *Cydia* (*Grapholitha*) *molesta*, Busck, before the twigs harden and the general attack on the ripening fruit occurs. During this long period, weather conditions and natural enemies are the only restrictive forces known to be effectively operative, but there are great local variations in the degree of control effected by different insect parasites. Of 8,178 parasites, representing 17 species, a list of which is given, reared from twig-infesting larvae in Tennessee in 1930–32, all but 367 were *Macrocentrus delicatus*, Cress. It is not until late in the season (normally from mid-July till all fruit has been removed from the orchards at the end of August) that a general infestation of peaches occurs. In 1932, of 1,942 cocoons from which either moths or parasites emerged between 8th July and 4th August (the period of emergence of the generation of moths that give rise to the fruit-infesting larvae), 69 per cent. contained parasitised larvae. This high rate of parasitism, affecting the most critical part of peach development, affords a more accurate measure of the practical results of the control exercised than is given by records for the complete season.

Although 27 colonies of parasites have been liberated during the years 1930–32, including *Macrocentrus ancylivora*, Roh., *Ascogaster quadridentatus*, Wesm., *Pristomerus vulnerator*, Panz., and *P. ocellatus*,

Cush. [*cf. R.A.E.*, A, xx, 215], *Trichogramma euproctidis*, Gir. (which is of European origin), and *Perisierola* sp. [*cf.* xx, 423], none has been recovered in sufficient numbers to indicate that it is effective in Tennessee orchards. *M. ancylivora*, which is quite valuable in New Jersey, has been unable to maintain its numbers in eastern Tennessee, although a single individual taken in 1932 shows that it has successfully survived two winters. In Tennessee, an alternative host seems to be necessary ; possibly one occurs that is suitable for *M. delicatus* but not for *M. ancylivora.*

English (L. L.) & Turnipseed (G. F.). **A Method for timing Sprays for the Control of Scale Insects on** *Citrus*.—*J. Econ. Ent.*, xxvi, no. 5, pp. 987–989, 1 pl., 1 graph. Geneva, N.Y., October 1933.

Data required for timing sprays against scale insects producing several overlapping generations each season on *Citrus* have been successfully obtained over a period of two years in southern Alabama from weekly records of active larvae caught in removable adhesive bands placed on infested branches of Satsuma orange trees [*cf. R.A.E.*, A, xx, 607]. Three bands were used on each record tree, each being placed on infested wood of a different age. They consisted of a strip of tape, $\frac{1}{4}$ inch wide, coated with collodion, on which a narrow thread of tanglefoot had been applied with a rubber syringe. For records of *Lepidosaphes beckii*, Newm., *L. gloveri*, Pack., or *Parlatoria pergandei*, Comst., they may be replaced on the same branches throughout an entire season ; for *Pseudaonidia duplex*, Ckll., their position should be changed when the number of active larvae has reached a minimum, owing to migration of the scales. Growers have been advised to spray one week after hatching reaches the maximum. After the first maximum of the season has been determined, following ones can be predicted with fair accuracy from knowledge of the life-cycle or by rearing adults from larvae collected at the time of the first maximum.

The data obtained by this method have shown that eggs of *L. beckii* continue to hatch throughout the mild winters of southern Alabama, and in spite of considerable overlapping, hatching reaches three distinct peaks during summer. Clean fruit has been obtained, even in severely infested orchards, by the application of lime-sulphur when hatching reaches the first maximum (the oranges being then too small for oil), followed by two applications of oil at the subsequent peaks. *P. duplex*, which does not hatch throughout the winter and has three distinct summer broods without overlapping, is also readily controlled by this method. Spraying without timing in the first year's work resulted in almost complete failure, but properly timed sprays in the two subsequent years satisfactorily controlled severe infestation.

Yates (W. W.). **A Study of the Effect of Accessory Substances on the Adherence of Lime Sulfur Spray to the Integuments of Pine Leaf Scale,** *Chionaspis pinifoliae* **(Fitch).**—*J. Econ. Ent.*, xxvi, no. 5, pp. 989–994, 4 refs. Geneva, N.Y., October 1933.

The amounts of residual sulphur adhering to 50 adults of *Chionaspis pinifoliae*, Fitch, after they had been immersed in 10 per cent. lime-sulphur, alone or with various spreaders, etc., were determined by a modified colorimetric method. Of 28 combinations used, 16 left a bigger residue than the unmixed spray, 4 approximately the same

amount (0·08 mg.) and 7 a smaller one. The biggest residue (0·145 mg.) was left by a combination with 1 per cent. sodium silicate. Combined with 0·05 per cent. Kayso as an emulsifier, drying linseed oil (1 per cent.) gave a slightly higher deposit (0·113 mg.) than either semi-drying fish-oil or cottonseed oil. Dried skim milk at 0·1 per cent. concentration left nearly the same residue (0·09–0·1 mg.) as liquid skim milk at 1·0 per cent. Calcium caseinate at 0·5 per cent. left 0·07 mg.; at 0·1 per cent., 0·103 mg.; and at 0·05 per cent., 0·116 mg. Blood albumen left the biggest residue (0·09 mg.) at the intermediate concentration of 0·1 per cent. It thus appears that there is an optimum amount of spreader, resulting in a maximum deposit of spray.

The integument of *C. pinifoliae*, which has a certain undetermined absorptive and adsorptive power, is not particularly hard to wet with lime-sulphur, which left a fairly uniform coating on the scales. With the method used, in which pine needles bearing scales were immersed in the liquid and immediately removed, the spray did not creep away from the waxy covering, as reported in a paper already noticed [*R.A.E.*,A, xix, 122].

Felt (E. P.). **Chinch Bug** (*Blissus leucopterus* **Say**).—*J. Econ. Ent.*, xxvi, no. 5, p. 994. Geneva, N.Y., October 1933.

Serious injury was caused to lawns in the north-eastern United States by *Blissus leucopterus*, Say, in the summer of 1933. Brown patches appeared, and if the affected grass was left untreated, it died. Repeated applications of a contact insecticide, such as a combination of potassium oleate and nicotine sulphate, or dusts of tobacco or of nicotine sulphate and lime, kill a proportion of the bugs, but do not affect the eggs. It is possible that fumigation with carbon bisulphide emulsion under canvas will give more efficient control.

Felt (E. P.). **The Pine Tip Beetle** (*Pityophthorus pulicarius* **Zimm.**).—*J. Econ. Ent.*, xxvi, no. 5, pp. 994–995. Geneva, N.Y., October 1933.

An unusually heavy infestation of Austrian pine [*Pinus nigra* var. *austriaca*] by *Pityophthorus pulicarius*, Zimm., is recorded from Connecticut, New York, and Pennsylvania. The presence of this Scolytid is indicated by the appearance at midsummer of dead tips with brown needles; in severe infestations, gradual killing back may ultimately affect branches of considerable size. After a general infestation of some years' standing, most of the tips and a large part of the tree may become browned at midsummer. The beetles, which make numerous burrows less than $\frac{1}{16}$ inch in diameter, may frequently be found in the affected tips.

Knowlton (G. F.). **Reappearance of the Colorado Potato Beetle in Utah.**—*J. Econ. Ent.*, xxvi, no. 5, p. 995. Geneva, N.Y., October 1933.

The Colorado potato beetle [*Leptinotarsa decemlineata*, Say], which has already been recorded several times from Utah [*R.A.E.*, A, xx, 296], was again found there in 1933 injuring potatoes over an area of a few square miles. Only a part of the fields was infested, although

farmers reported that the beetle had been present for two or three seasons. As the infested area is crossed by two railways, it is possible that the insects were introduced in railway wagons.

RICHARDSON (H. H.). **Preparation of Derris Extract Sprays.**—*J. Econ. Ent.*, xxvi, no. 5, p. 995. Geneva, N.Y., October 1933.

Coagulation that occurred in preparing sprays with commercial concentrated acetone extracts of derris (containing 2·3–5 gm. rotenone per 100 cc. with a total of 16–18 per cent. derris extractives) when 1 part of the extract was added to 250–500 or more parts of water, soap solutions or solutions of various other wetting agents, was overcome by previously diluting the extract with acetone (1 : 1). Residues from sprays so prepared retained their toxicity to thrips much longer when sulphonated castor oil (1 : 400) was used as the wetting agent instead of potassium coconut-oil soap (1 : 300). Sprays containing sulphonated castor oil (turkey red oil) effectively wetted the foliage of various plants, including gladiolus, rose and onion.

CUTRIGHT (C. R.). **Specific Defoliation Data on Apple.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 995–996. Geneva, N.Y., October 1933.

An exact record of defoliation caused by insecticides on apple trees has been obtained by counting the scars left by fallen leaves on 20 representative terminals on each tree. This method has also been successfully used by M. A. Vogel in determining relative rates of spray injury on peaches.

GWIN (C. M.). **The past and present Status of Fluorine Containing Insecticides.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 996–997. Geneva, N.Y., October 1933.

The author reviews the literature dealing with the progress since 1915 of the use of fluorine compounds as insecticides, which has been considerably developed during the past seven years. The recent appearance of papers dealing with the chronic toxicity of fluorine to man [*R.A.E.*, A, xxi, 254, etc.] has resulted in an unwarranted curtailment of research on this subject. As no completely satisfactory insecticide has yet been discovered, insecticides containing arsenicals or fluorides cannot yet be dispensed with.

SHEPHARD (H. H.). **The Use of the Term "Pyrethrin" by Entomologists.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 997–998, 12 refs. Geneva, N.Y., October 1933.

Confusion exists in the literature of plant chemistry in regard to the use of the term "pyrethrin," which was first employed in 1876 by Buchheim to designate the active principle of the roots of *Anacyclus pyrethrum*, known as "pellitory" in medicine. Because *Pyrethrum* was for a long time also the generic name of plants of the genus *Chrysanthemum* that are the source of insect powder, the term pyrethrin has been recently applied to the active principles of that insecticide [*R.A.E.*, A, xiii, 298]. A few facts concerning the nature of pellitory and of insect powder are given, together with an outline of the history of the term pyrethrin. It is concluded that as pellitory is a drug of minor and waning importance, whereas pyrethrum flowers are very

widely used and are becoming increasingly important as insecticides, it is neither feasible nor desirable to restore the term to its original usage, though ambiguity should be avoided by reference to the plant source.

COCKERELL (T. D. A.). **The Honey Bees of Africa.**—*J. Econ. Ent.*, xxvi, no. 5, pp. 998–1000. Geneva, N.Y., October 1933.

The author briefly discusses the characters and distribution of the honey-bees of Africa and concludes from an examination of a large collection from nearly all parts of the Ethiopian region that all forms hitherto recognised there may properly be considered races or subspecies of *Apis mellifera*, L. (*mellifica*, L.).

BOX (H. E.). **Sugar-Cane Moth Borer** (*Diatraea*) **Investigations. Outline of Work done in Antigua during the Year 1931.**—10 pp., 1 ref. **Outline of Work done in Antigua and St. Kitts during the Year 1932.**—40 pp., 16 refs., 1 diagr. Antigua, Colon. Developm. Fund, 1933.

The information given in the first paper and some of that contained in the second has already been noticed [*R.A.E.*, A, xx, 582, 708 ; xxi, 542]. In 1932, losses in fields of sugar-cane infested with *Diatraea saccharalis*, F., varied considerably, even with the same degree of joint infestation, according to the variety of cane and its general condition as determined by the type of land, the agricultural practices and the prevailing climatic conditions. Where as many as 39·6–46·1 per cent. of the joints were infested, the direct measurable loss amounted to 11·3–13 tons per acre. In the Islands as a whole, the yearly average minimum is probably 3 tons in every acre cultivated. Various factors, including entire destruction of jointed canes of different ages, of which as many as 25 per cent. sometimes have to be discarded at harvest, direct destruction of planting material or interference with germination, and the entry of secondary insects and fungi into the inner tissues of the stalks through borer tunnels, combined to make the total loss probably much greater than a previous estimate [xxi, 162]. Further species of grasses were found to be alternative food-plants [*cf.* xx, 583]. In Nevis, *Paspalum virgatum*, which has replaced sugar-cane in abandoned lands, was not attacked, though it is greatly favoured elsewhere. In Antigua, fields planted during November–December with selected, borer-free seed canes [*cf.* xxi, 656] placed flat in furrows and 2 ft. apart, were in a superior condition to those planted in November according to the traditional method. In the latter, only 33 per cent. of the plants germinated.

Consignments of *Eulimneria alkae*, Ell. & Sacht. (*crassifemur*, auct.) and *Microgaster tibialis*, Nees, which are parasites of *Pyrausta nubilalis*, Hb., in Europe, were collected in France and forwarded from England by the Imperial Institute of Entomology against *Diatraea*, which they would be most likely to attack in maize. Most of the parasites had died in transit, and no instance of successful parasitism was observed experimentally ; in two cases, larvae of *Eulimneria* were found developing in those of *Diatraea*, but they died without forming cocoons. Further consignments have been introduced with a lower mortality, and liberations have been made, but neither parasite has yet been recovered in the field.

The greater part of this report is devoted to information on *Lixophaga diatraeae*, Towns., of which *Hypostena* (*Tachinophyto*) *grisea*, Curran,

[xv, 52] is a synonym, and its introduction into Antigua and St. Kitts [xxi, 162, 647] against *D. saccharalis*, its only known host. The eggs of the Tachinid hatch within the female parent 6–7 days after pairing, 3–4 larvae being deposited near a borer tunnel, into which they are attracted by the darkness. In view of the high potential number of larvae (over 200), it is probable that only a small percentage succeed in locating and penetrating a host. The larval period is passed within the host and varies with the size of the latter, being longer in small hosts. In the laboratory, 4 small but otherwise normal flies were reared from one large borer [*cf.* xix, 215]. Each generation occupies 20·5–33 days, and there are thus 13 annually, about twice the number produced by *Diatraea*.

Tins each containing about 100 pupae collected in Cuba 4–10 days previously were transported by air, an average of 81·2 per cent. surviving. At first, adults were released as they emerged (beginning 27th March in Antigua and 23rd April in St. Kitts), but as a rearing technique was evolved, females that had been fertilised in the laboratory and kept in cages during the period of gestation were included and finally used exclusively. Liberations were first made in particularly favourable areas. The fertile females were released at the rate of 20–60 every 2–4 weeks, and the males in batches of about 150 (when too many had accumulated in the pairing cages) in areas containing females of the previous generation. Of larvae taken for breeding purposes from females (dissected in saline solution 7–10 days after pairing) [*cf.* xix, 214] and placed singly on small or medium-sized borers and 2–3 together on larger ones, nearly 65 per cent. developed to pupae. The host larvae were kept in glass jars containing cane shoots. The parasite puparia were kept in rearing-boxes or glass tubes until the adults were ready to emerge. Mortality of the parasite larvae was due to *Cordyceps* and a wet rot, probably of bacterial origin, which attack the host, and also to their failure to penetrate the latter. Nine generations, reared intermittently during the course of the work, gave rise to 8,315 flies, about 50 per cent. of which were females fertilised under laboratory conditions and (except for small numbers retained for dissection) liberated in infested fields.

The progress of the parasite in the field was studied in a few sample areas. On one estate in Antigua, parasitism was first discovered on 1st May, and from 4·2 to 30·1 per cent. was recorded until November. In one field, examination of 20 stools revealed 30·7 per cent. parasitism. Pupae were collected from this field to supplement those being reared in the laboratory, about 1,400 (from which 1,219 adults were reared) being secured between November 1932 and January 1933 without seriously depleting the number in the field. In April 1933 (as stated in an appendix), 30 per cent. parasitism was discovered, and though 96·8 per cent. of the stalks were infested, the average number of infested joints in an infested stalk was only 5·4, as compared with 4·7 in December 1932, which is an unusually low rate of increase. Seven small Hymenoptera, distinct from the Diapriids that parasitise *L. diatraeae* in Cuba, emerged from one puparium in December, but this hyperparasite is not considered to be of any great importance. In St. Kitts, 1·9 per cent. parasitism by *Lixophaga* was discovered in early August in two estates, and evidence of its presence in others in December. Natural distribution was observed to have taken place in both islands.

Monte (O.). **Mais dois Coccinelideos que são nocivos ás Cucurbitaceas.** [Two more Coccinellids injurious to Cucurbits.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, v, no. 2, pp. 30–34, 2 figs. Belo Horizonte, February 1932. [Recd. October 1933.]

Two more Coccinellids [*cf. R.A.E.*, A, xix, 686], *Epilachna marginella*, F., and *E. cacica*, Guér., the adults of which are briefly described, have been observed in Brazil, in the State of Minas Geraes, feeding on the leaves of Cucurbits, the larvae being confined to the lower surface. The injury is comparatively unimportant, but, if necessary, an arsenical spray could be used for control.

Monte (O.). **Alguns Cassidideos, pragas da batata doce.** [Some Cassidid Pests of the Sweet Potato.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, v, no. 4, pp. 43–46, 9 figs. Belo Horizonte, April 1932. [Recd. October 1933.].

In Minas Geraes, sweet potato (*Ipomoea batatas*) is attacked by the Cassidids, *Poecilaspis ruforeticulata*, Boh., *Chelymorpha rufipennis*, Boh., *Echoma dichroa*, Germ., *Neomphalia cyanea*, L., *Chirida cruciata*, L., *Chelymorpha marginata*, L., *Metriona judaica*, F., *M. sexpunctata*, F., *Ctenochira aciculata*, Boh., and *Chelymorpha* sp. They are seldom injurious, but could be controlled by arsenical sprays.

Monte (O.). **As pragas das aboboreiras.** [Pests of Gourds.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, v, no. 4, pp. 65–69, 3 figs. Belo Horizonte, April 1932. [Recd. October 1933.]

In the State of Minas Geraes, the Pyralids, *Diaphania nitidalis*, Stoll, and *D. hyalinata*, L., oviposit on the fruits, stalks and leaves of gourds, and the larvae mine in the stems and fruits. The egg stage lasts 3–4 days, the larval about 12, and the pupal stage in the soil 7–10. The larvae of the Aegeriid, *Melittia satyriniformis*, Hb., live in the stems, causing the plants to die, and also pupate in the soil. These three moths are sometimes very injurious, but may be controlled by collection and burning of all infested material. The Galerucids, *Diabrotica speciosa*, Germ., and *D. bivittula*, Kirsch, which is especially harmful, and the Coccinellids, *Epilachna cacica*, Guér., and *E. marginella*, F., attack the foliage, and may be dealt with by collection or arsenical sprays. A spray of nicotine and soap is effective against *Aphis gossypii*, Glov., and the Coreid, *Leptoglossus gonagra*, F., which is common but does little harm.

Monte (O.). **A cochonilla branca da amoreira** (*Aulacaspis pentagona*, **Targ.**). [The White Scale of Mulberry.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, v, no. 6, pp. 57–60, 8 figs. Belo Horizonte, June 1932. [Recd. October 1933.]

Mulberry and peach in Minas Geraes are severely attacked by *Aulacaspis pentagona*, Targ., though it is heavily parasitised by *Prospaltella berlesei*, How. The usual measures are suggested for its control.

MONTE (O.). **As cigarrinhas sugadoras.**—*Bol. Agric. Zootec. Vet. Minas Gerais*, v, no. 7, pp. 39–60, 20 figs., 19 refs. Belo Horizonte, July 1932. [Recd. October 1933.]

Very brief notes are given on the bionomics and control of a large number of Homopterous pests of plants of economic importance in Brazil.

MONTE (O.). **Sobre percevejos Pentatomideos que atacam Solanaceas cultivadas.** [On Pentatomids that attack cultivated Solanaceous Plants.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, v, no. 11, pp. 313–314, 2 figs. Belo Horizonte, November 1932. [Recd. October 1933.]

Tobacco is attacked in Minas Geraes by *Edessa rufomarginata*, DeG., which appears in April, and tomato by *Arvelius albopunctatus*, DeG., which appears in November. Both Pentatomids oviposit on the leaves. The egg stage lasts 10 days, and the nymphal about 2 months. These bugs have not been observed to cause much damage.

MONTE (O.). **A vaquinha azul do feijão.** [The Blue Halticid of Beans.] —*Bol. Agric. Zootec. Vet. Minas Gerais*, vi, no. 1, pp. 49–50, 1 fig. Belo Horizonte, January 1933. [Recd. October 1933.]

The adults of the Halticid, *Diphaulaca volkameriae*, F., attack the leaves of beans in Minas Geraes, and the larvae feed on the roots or the stems near the soil surface. It was always found with the Eumolpid, *Colaspis prasina*, Lef., which appears to be a pest of beans as well as of sweet potato. *D. volkameriae* probably has more than one generation a year, but is most abundant in December.

MONTE (O.). **Lepidobroca da laranjeira** (*Xyleutes strigillata*, **Felder).** [A Lepidopterous Borer of the Orange Tree.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, vi, no. 2, pp. 95–98. Belo Horizonte, February 1933. [Recd. October 1933.]

A larva of the Cossid, *Xyleutes strigillata*, Feld., has been found boring in a branch of an orange tree in Minas Geraes, the mine being $2\frac{1}{2}$ inches long with an orifice $1\frac{3}{4}$ inches in diameter. It closed its mine with fragments of wood in order to pupate, the adult emerging about 2 months later.

MONTE (O.). **Uma lagarta que broqueia o tomate.** [A Caterpillar boring into Tomatos.]—*Bol. Agric. Zootec. Vet. Minas Gerais*, vi, no. 6, pp. 357–359, 1 fig. Belo Horizonte, June 1933. [Recd. October 1933.]

The Pyralid, *Leucinodes elegantalis*, Gn., is considered to be responsible for 50 per cent. of the losses in the tomato crop in Minas Geraes. The eggs are laid in August and September on the fruits and hatch within 10 days. Up to 3 eggs are deposited on a fruit, close to the calyx or even on the sepals. The larvae pupate in débris beneath the plants ; a pupal period of 17 days was observed, ending 6th October. Infested tomatos should be picked and burnt or buried 2 ft. deep, or the young fruits may be sprayed with lead arsenate or Paris green when the first larvae are noticed.

Müller (A. S.). **Observations and Notes on Citrus Diseases in Minas Geraes, Brazil.**—*Phytopathology*, xxiii, no. 9, pp. 734–737. Lancaster, Pa., September 1933.

Scale insects that attack *Citrus* in Minas Geraes are partly controlled by five species of parasitic fungi found throughout the year, *viz.*: *Cephalosporium lecanii*, *Tubercularia coccicola*, *Myriangium duriaei*, *Podonectria* sp. and *Microcera* sp.

Vaughan (E. K.). **Transmission of the Crinkle Disease of Strawberry.**—*Phytopathology*, xxiii, no. 9, pp. 738–740, 1 fig., 3 refs. Lancaster, Pa., September 1933.

During the winter of 1931–32, laboratory experiments were carried out in Oregon to determine whether "crinkle disease" of strawberry is a virus disease transmissible by *Pentatrichopus potentillae*, Wlk. (*Myzus fragaefolii*, Ckll.) [*cf. R.A.E.*, A, xv, 400; xvi, 408, 438; xxi, 296]. When Aphids on diseased plants were transferred to healthy ones, 84 per cent. of the latter developed symptoms of crinkle, though these disappeared later in 54·76 per cent. The disease was not induced by Aphids that had not acquired the infection or by the offspring (first instar) of infected adults.

Graber (L. F.) & Sprague (V. G.). **Alfalfa Yellows.**—*Science*, lxxviii, no. 2026, pp. 385–386. New York, 27th October 1933.

In Wisconsin, the stunting and yellowing of lucerne that is caused primarily by *Empoasca fabae*, Harr., appears principally in the second growth. Observations over a period of two years show that injury to the first crop is seldom of much importance. When this is not mown until the field is in full bloom, most of the leafhopper eggs are removed with the crop, thus greatly reducing infestation of the second growth. When, however, the first crop is mown earlier, oviposition is continued by surviving and migrating adults, and the resulting nymphs were found, in specific trials, to reduce the yield of the second growth by 66–75 per cent. In a series of plots, half of each was mown on 9th June and half on 21st June. In the former, the growth of the second crop was stunted and yellow, and on 15th July 29 times as many nymphs were found in it as in the latter. Since the nymphs do not begin to migrate until they have approached the adult stage, the second growth from the later mowing was at first quite healthy. A few days before the mowing of the second growth on 31st July, most of the nymphs had become adult and through migration caused a yellowing of all the lucerne. After this, however, they rapidly disappeared, conditions being apparently unfavourable for their propagation during the period of the third growth.

Lindquist (A. W.). **Amounts of Dung buried and Soil excavated by certain Coprini (Scarabaeidae).**—*J. Kans. Ent. Soc.*, vi, no. 4, pp. 109–125, 2 pls., 15 refs. McPherson, Kans., October 1933.

The literature dealing with insects as soil builders is reviewed. In view of their beneficial effect on the soil, investigations were undertaken in Kansas in 1929–30 on the habits of a few Coprids. The following is taken from the author's summary: Dung beetles were found wherever cattle grazed. Dung was buried from 1st May until early autumn by

Pinotus carolinus, L., which stores it in a branch off each burrow, and by *Copris tullius*, Ol., and *Phanaeus* spp., which store it at the end of their tunnels, the former in an oblong cavity. The average amounts of dung stored were 48·5, 7·26 and 9·62 gm., and of soil excavated 287·1, 37·8 and 93·4 gm. respectively. In the autumn, vertical burrows containing no stored manure are constructed, probably for purposes of hibernation [*cf. R.A.E.*, A, xvi, 195].

SNYDER (T. E.). **Injury to Buildings by Termites.**—*Leafl. U.S. Dept. Agric.*, no. 101, 8 pp., 2 figs. Washington, D.C., September 1933.

This revision of a previous leaflet [*R.A.E.*, A, xviii, 114] includes additional information on the temporary control of termites by the application of soil poisons round the foundations of buildings. The most promising is a full-strength, crude, liquid orthodichlorobenzene, applied at the rate of 1 U.S. gal. per 10 linear feet in a trench 2–3 ins. deep. All wood débris should be removed from the vicinity of the foundation walls, and the earthen shelter-tubes of the termites broken off. In the neighbourhood of ornamental plants, which might be injured by the liquid material, paradichlorobenzene crystals (about 5 lb. per 10 linear feet) may be placed in a trench 3 ins. deep to a depth of 2 ins. and then covered with loose earth.

OMAN (P. W.). **A Classification of North American Agallian Leaf Hoppers.**—*Tech. Bull. U.S. Dept. Agric.*, no. 372, 93 pp., 18 figs., 4 pls., 45 refs. Washington, D.C., August 1933.

This is a revision of the North American species of *Agallia*, *Agalliopsis* and *Aceratagallia*, which the author treats as distinct genera, together with notes, largely based on the literature, on their food-plants and habitats. The author erects a fourth genus, *Agalliana*, to include one species, *Agallia sticticollis*, Stål. The economic importance and distribution of the more injurious species are discussed. The damage done by these Jassids has been greatly underestimated, partly because the injury when observed was usually attributed only to *Aceratagallia sanguinolenta*, Prov. [*R.A.E.*, A, xx, 16] or to drought. Data from the literature indicate that most of them become pests of crops only when their normal food-plants are not available, but this is often the case in extensively cultivated regions. The principal crops affected are clover, lucerne, soy beans and beet. Most of the species of major economic importance for the United States occur in the genus *Aceratagallia*, the commonest being *A. sanguinolenta*, which is very abundant in the eastern part of the States, attacking beans, clover, lucerne, Japanese clover (*Lespedeza striata*), which is a valuable forage crop, and *Cassia chamaecrista*, but probably does not occur further west than Utah and Arizona. Two species of importance in California and Oregon are *A. curvata*, sp. n., found chiefly on lucerne, and *A. obscura*, sp. n., taken on 22 different crops. In the genus *Agallia*, the best-known injurious species are *A. constricta*, van D., and *A. quadripunctata*, Prov., of which the former is common in the south-eastern part of the United States, and the latter in the north-east. *A. albidula*, Uhl., and *Agalliana sticticollis* attack vegetable crops throughout the Antilles.

The characters used in the classification of these leafhoppers are discussed, with notes on the technique used in the preparation and

handling of specimens. Descriptions are given of all the genera and species, with keys to them and notes on their distribution. They include 45 new species, 1 new subspecies and 3 new varieties.

Swaine (J. M.). **The Relation of Insect Activities to Forest Development as exemplified in the Forests of Eastern North America.**—*Sci. Agric.*, xiv, no. 1, pp. 8–31, 7 refs. Ottawa, September 1933.

The author reviews the changes in the virgin forests of eastern North America that have resulted in the gradual evolution of the present type, and the part played by insects in the destruction of timber, with notes on outbreaks of *Tortrix* (*Cacoecia*) *fumiferana*, Clem., *Lygaeonematus erichsoni*, Htg., *Coleophora* (*Haploptilia*) *laricella*, Hb., *Ellopia fiscellaria*, Gn., *Dendroctonus piceaperda*, Hopk., *Chermes* (*Dreyfusia*) *piceae*, Ratz., *Diprion polytomum*, Htg., *Peronea variana*, Fern., and *Cryptococcus fagi*, Bär. He also discusses many interesting aspects of the relation between the insect fauna and the other life of the forest, especially food-plants, parasites and predators, and fungi, as well as the factors influencing insect outbreaks, such as climate and weather, changes in the vitality of the species concerned, food-supply, and the alteration of forest types by the intervention of man. The problems involved include the periodicity of insect activity and the occurrence of outbreaks of a given species in widely separated areas at about the same time, changes in the habits of insects brought about by variations in environmental resistance, the selection of food-plants of particular species or trees in a particular condition, and the reaction of trees to insect attack. Various instances are given to show the need for further studies of the biology of forest insects.

Gibson (A.). Ed. **Entomological Research Projects in Progress in the Dominion of Canada 1933.**—Multigraph 154+7 pp. Ottawa, Res. Comm. Canad. Soc. Tech. Agric., 1933.

This annotated list of projects includes sections concerned with insect pests in forests, orchards, fields, greenhouses, gardens, stored products and houses, and with insecticides, insect surveys, taxonomy, morphology and bionomics. Author and subject indices are given.

Payne (N. M.). **The Differential Effect of Environmental Factors upon** *Microbracon hebetor* **Say (Hymenoptera; Braconidae) and its Host** *Ephestia kühniella* **Zeller (Lepidoptera; Pyralidae). I.**—*Biol. Bull.*, lxv, no. 2, pp. 187–205, 3 diagr., 23 refs. Lancaster, Pa., October 1933.

In laboratory experiments, the total life-cycle of *Microbracon hebetor*, Say, parasitising *Ephestia kühniella*, Zell., ranged from 7 days at 36°C. [96·8°F.] to 30 days at 15°C. [59°F.], and that of two strains of the host, reared on oats, from 35–37 and 62–65 days respectively at 32°C. [89·6°F.] to 140–175 and 205–243 days at 10°C. [50°F.]. At 8°C. [46·4°F.], only the slower strain of the moth developed (in 250–270 days). Adult female parasites lived 3 days at 36°C., 20 at 27°C. [80·6°F.], and 90 at 10°C. [*R.A.E.*, A, xx, 178].; below 14·5°C. [58·1°F.], they did not lay eggs. The number laid on one larva averaged 10 [*cf.* xix, 630]. The reproductive potential of the parasite (calculated by multiplying the average number of eggs laid per female by the fraction of the total population represented by females that actually

laid eggs) was 67·5 at 36°C. and 28 at 15°C., with a maximum of 90 at 27°C. [80·6°F.]; that of the host was (approximately) 68·6 at 32°C. and 3 at 8°C., with a maximum of 85 at 27°C.

Experiments are described in each of which 10 adult parasites were placed with 100 host larvae, eggs or pupae. When the parasite was able to complete two generations during the larval stage of the host, the latter was exterminated. Since eggs were laid only on larvae from the second instar onwards, parasites confined with eggs or pupae were not able to reproduce so rapidly; in the latter case, they were able to exterminate the slower strain of the host only at 20–27°C. [68–80·6°F.], and the faster only at 27°C. In general, heat and moisture were relatively favourable to the host and unfavourable to the parasite. The host-parasite balance was also affected by other factors, the host being favoured by darkness and by the occurrence of relatively or wholly immune larvae (characterised by a pinkish colour).

Meier (O. W.) & Parfentjev (I. A.). **Die Bekämpfung des Kartoffelkäfers** (*Leptinotarsa decemlineata* **Say**). [The Control of the Potato Beetle.]—*Anz. Schädlingsk.*, ix, no. 10, pp. 121–123, 14 refs. Berlin, October 1933.

An account is given of dusting experiments against *Leptinotarsa decemlineata*, Say, on potato, carried out by the authors in June 1931 in Missouri to compare the efficiency of standard American calcium arsenate with that of a German calcium arsenate of greater adhesiveness. It was found that 5 lb. of either dust per acre produced a very high mortality that rose to 100 per cent. with $7\frac{1}{2}$–10 lb. With that of higher adhesiveness, the amount of arsenic (As_2O_3) on the foliage 1, 2 and 3 days after application was very much larger than with the standard preparation.

Blattny (C.). **Eine Milbenkrankheit bei Amaryllis.** [A Mite Disease in Amaryllis.]—*Gartenbauwiss.*, vii, no. 4, pp. 489–495. (Abstr. in *Anz. Schädlingsk.*, ix, no. 10, pp. 127–128. Berlin, October 1933).

Bulbs of *Amaryllis* in greenhouses in Bohemia have been attacked by *Tarsonemus hydrocephalus*, Vitzth. Red spots appeared on the bulbs, stems and leaves of infested plants, which sometimes died. Many of the mites just below the surface of the bulbs can be killed by dipping them for 30 minutes in water at 40°C. [104°F.] before storing for the winter.

Vitzthum (H.). **Einiges über** *Microtrombidium demeijerei* **und sein Atmungssystem.** [Notes on *M. demeijerei* and its Respiratory System.]—*Zool. Anz.*, civ, no. 7–8, pp. 217–220, 1 fig. Leipzig, 15th October 1933.

The larvae of the mite, *Microtrombidium demeijerei*, parasitise the adults of *Oscinella frit*, L., and *Platyparea poeciloptera*, Schr., in Germany, and prevent the maturation of the ovaries.

Hase (A.). **Ueber die Mehlmottenmilbe** *Typhlodromus tineivorus* **Oudemans 1929. Eine Berichtigung.** [On the Meal Moth Mite, *T. tineivorous*. A Correction.]—*Zool. Anz.*, civ, no. 7–8, pp. 237–239, 7 refs. Leipzig, 15th October 1933.

The mite often found on *Ephestia kühniella*, Zell., and recorded in papers by German authors, including one already noticed [*R.A.E.*, A,

viii, 331], as *Seiulus muricatus*, Koch, is here stated to be *Typhlodromus tineivorus*, Oudm. [xviii, 95]. It feeds in all stages on the eggs of the moth and is a serious pest in cages in which *E. kühniella* is being bred, though of some value in mills, etc. It also destroys the eggs of *Cimex lectularius*, L., *Anthrenus* spp. and other insects.

DINGLER (M.). **Ueber das Auftreten und die Bekämpfung des grossen braunen Rüsselkafers,** *Hylobius abietis* **L., in den hessischen Forstämtern 1929–1932.** [On the Appearance and Control of *H. abietis* in the Hessian Forest Districts in 1929–1932.]—*Ber. oberhess. Ges. Natur- u. Heilk.*, (N.F.) xv, pp. 297–306, 2 maps, 2 refs. Giessen, 1933.

The conifers chiefly attacked by *Hylobius abietis*, L., in Hesse are those 2–6 years old [*cf. R.A.E.*, A, xx, 491], and the feeding of 3 weevils appears to be sufficient to ring a young tree completely and kill it. The weevils appear in early spring, the peak of the damage occurring in May–June. The usual method of control is to use as traps pine billets or spruce bark placed at short intervals round the plantation.

VON LENGERKEN (H.). **Das Schädlingsbuch.** [The Book of Pests.]—Demy 8vo, 194 pp., 88 figs., 1 p. refs. Berlin, Brehm Verlag, 1932. Price *M*. 4.80. [Recd. November 1933.]

This book deals with the pests, chiefly insects, injurious to plants in gardens in Germany. Lists are given of the various forms of injury met with in fruit trees, vegetables and ornamental plants, followed by a section in which brief notes are given on the bionomics and control of the individual pests, arranged in systematic order. An alphabetical list of insecticides and equipment for control measures obtainable in Germany, a bibliography of the more important German literature and an index are included.

HUS (P.). **De ontwikkeling van Carbolineum als bestrijdingsmiddel in de fruitteelt.** [The Development of Carbolineum against Orchard Pests.]—*Tijdschr. PlZiekt.*, xxxix, no. 9, pp. 232–245. Wageningen, September 1933.

This is a summary of a lecture describing the development in Holland of the use of tar distillates against diseases and insect pests of fruit trees and bush fruits, the experience gained as to their action and the modifications they have undergone in manufacture.

WERNECK (H. L.). **Die Maulwurfsgrille** (*Gryllotalpa vulgaris* **Latr.**) **und ihre wirtschaftliche Bedeutung für Oberösterreich.** [The Mole-cricket, *G. gryllotalpa*, L., and its Economic Importance in Upper Austria.]—*Neuheiten PflSch.*, xxvi, no. 5, pp. 97–101, 4 refs. Vienna, October 1933.

Gryllotalpa gryllotalpa, L. (*vulgaris*, Latr.) is a very injurious pest of cultivated plants in Upper Austria, where it occurs chiefly in the lower valleys at an altitude of about 1,500 ft. It appears to prefer young cereals and beet, and also attacks all kinds of vegetables, meadow grasses and lucerne. Near Linz, it was observed in 1930

as early as 22nd March, and in 1932 severe injury occurred as late as 10th November. The greatest damage was done in May and June. The first eggs were found at the end of April or early in May, and oviposition continued until late October if the weather was favourable, contrary to the usual statement that it ceases in July. There were thus several overlapping generations. About 200–300 eggs occurred in each nest, and the nests were sometimes only about an inch below the surface in well-trodden paths. The adults were abundant along the numerous small streams and avoided clay or dry soils. Several hundred were observed at a lamp on one night in June. They are preyed on by birds and insectivorous animals, and their increase may be checked by prolonged cold or wet weather, which has been observed to render them susceptible to a fungous disease.

Commission d'études des ennemis des arbres, des bois abattus et des bois mis en oeuvre.—Bull. no. 7, 8 pp., 4 figs. ; Bull. no. 8, 13 pp., 4 figs. ; Bull. no. 12, 6 pp., 3 figs. ; Bull. no. 14, 11 pp., 4 figs. Nancy, Adm. Eaux For., 1931–32. [Recd. October 1933.]

The seventh and eighth bulletins of this series have already been noticed from other sources [*R.A.E.*, A, xx, 46, 241]. In the twelfth, notes are given on the bionomics of the Cerambycids, *Hylotrupes bajulus*, L. [xvii, 327] and *Criocephalus rusticus*, L., both of which infest coniferous building timber in France. The adults of *C. rusticus* appear in June and July and lay their eggs in the bark of stumps and trunks of recently felled conifers. They do not oviposit in timber from which the bark has been removed. The larvae hatch 15–20 days later, pierce the bark and live for some time between it and the wood. The stage at which the sap-wood is entered varies, apparently depending on the thickness of the bark and the severity of the winter. Larvae at the same stage of development may be found simultaneously beneath the bark and in the wood. They form their galleries in all directions, not very deep in the wood, and return toward the surface to pupate in May and June, after which the adults soon emerge. Numbers have been observed to emerge from the main joists of a pine frame covered with a layer of plaster 2 inches in thickness [*cf.* also x, 2].

Wood infested by either of these Cerambycids should be carefully planed down to the depth of the galleries, all shavings being immediately burnt and the wood treated with a preservative such as creosote. Furniture, etc., can be fumigated with carbon bisulphide, calcium cyanide (2 oz. to 1,000 cu. ft.) or chloropicrin. Repeated injections of benzene, followed by stopping up the holes with wax, will kill the insects if no other measure is practicable.

In the fourteenth bulletin, it is shown that "worm-holes" in furniture and woodwork are due to the Anobiids, *Anobium punctatum*, DeG. (*striatum*, Ol.), *Nicobium* (*A.*) *castaneum* var. *hirtum*, Ill., *Xestobium* (*A.*) *rufovillosum*, DeG., *Ptilinus pectinicornis*, L., and *Oligomerus ptilinoides*, Woll., and to *Lyctus linearis*, Goeze, and *L. brunneus*, Steph. Characters distinguishing these beetles are given, with brief general notes on their bionomics. The control measures recommended are similar to those already noticed [xx, 241], with the addition of particular precautions to be taken in dwellings and museums, where old furniture should be periodically examined and treated at the first signs of infestation.

Ferraris (T.). **Un terribile devastatore di barbatelle.** [A very destructive Pest of grafted Slips.]—*Giorn. Agric. Domenica*, xliii, no. 24, p. 236, 1 fig. Rome, 11th June 1933.

In the spring of 1933, thousands of grafted vine slips at Alba, Piedmont, were destroyed, owing to their American stocks being attacked underground by the Dynastid, *Pentodon punctatus*, Villers. Both larvae and adults were abundant, together with some of *Amphimallus solstitialis*, L., and a very few adults of *Oryctes nasicornis*, L. The larvae of *P. punctatus* live for two years in the ground, feeding on roots and other vegetable matter. In July, they pupate in an earthen cell [*cf. R.A.E.*, A, xvi, 344], in which the adults hibernate, though they may emerge temporarily from the ground in autumn. They emerge in March–April, and pair at the end of spring. The eggs hatch in about a month. Large numbers of larvae, pupae and adults can be dug up in autumn and early spring or killed by injecting carbon bisulphide into the soil [*cf.* xix, 290]. Some chemical manures are useful repellents in spring and early summer.

Menozzi (C.). **L'attuale situazione dopo un triennio di lotta e di studi sugli insetti dannosi alla bieticoltura italiana.** [The present Position after three Years of Work against, and Studies on, the Insects injurious to Italian Sugar-beet Cultivation.]—*Atti Soc. ital. Progr. Sci.*, xxi Riun., vol. iii, reprint 6 pp. Pavia, 1933.

This is a summary of the data obtained during three years' work on the chief insect pests of sugar-beet in Italy [*cf. R.A.E.*, A, xx, 654, 655 ; xxi, 267, etc.].

Krüger (G.). **Cyrenaica : Some Insects injurious to Crops.**—*Int. Bull. Pl. Prot.*, vii, no. 10, pp. M 227–M 228. Rome, October 1933.

Examples of the swarming phase of *Schistocerca gregaria*, Forsk., were found in Cyrenaica about the middle of March 1933, and the solitary phase, which until the end of 1931 was localised in dunes on the west coast of southern Benghazi, had extended considerably towards the east-north-east. After the application of control measures in 1931, *Dociostaurus maroccanus*, Thnb., was not found in the Barce region up to the end of July 1933, but a few adults were observed in other districts about the end of June.

From December 1932 to the end of February 1933, the plain of Barce was invaded by large numbers of larvae of the Arctiid, *Ocnogyna mutabilis*, Turati, which were controlled by crushing underfoot, or by a 1 per cent. sodium arsenite spray. A few larvae of *Gelechia* (*Bryotropha*) *plebeiella*, Zell., were found on tomatos in May 1933 ; export of tomatos to Europe was stopped.

Harris (W. V.). **The Red Locust.**—*Pamph. Dept. Agric. Tanganyika*, no. 10, 10 pp., 1 pl., 3 figs., 15 refs. Dar-es-Salaam, 1933. Price *Cts.* 50.

Notes are given on records of the occurrence of *Nomadacris septemfasciata*, Serv., prior to 1929, with an account of the movements of swarms in Tanganyika Territory in 1930–32, during which breeding was confined to the Ufipa area. In 1933, breeding and migrations

were more extensive, some of the swarms passing into Uganda and the Ruanda-Urundi Territory of the Belgian Congo.

A description of hoppers and adults and illustrations of the phases, with some biometric measurements of the adults and particulars on the bionomics of this locust in Tanganyika Territory, where there is one generation a year, are included. It is suggested that the adults that appeared in 1930 may have been the offspring of locusts already present in the old Rukwa Lake bottom, which may be a permanent breeding ground.

The hoppers feed mainly on grasses and cereals ; the adults also attack ground-nuts (*Arachis*), pigeon pea (*Cajanus*), beans, leguminous cover crops, *Acacia* and other trees of the drier bush, cruciferous vegetables, *Citrus* and banana.

JACK (R. W.). **Notes on the Biology and Control of the Red Locust in Southern Rhodesia, 1932–33. Part I. Control of Locusts.**—*Rhod. Agric. J.*, xxx, no. 10, pp. 791–814, 1 pl., 3 refs.
MOSSOP (M. C.). **Part II. Biological Notes on the Red Locust,** *Nomadacris septemfasciata*, **Serv.**—*T.c.*, pp. 815–837, 1 pl., 1 fig., 1 ref. Also as [*Bull.*] *Minist. Agric.* [*S. Rhod.*] no. 904, 47 pp., 2 pls., 1 fig., 4 refs. Salisbury, S. Rhodesia, October 1933.

In the first paper, the usual mechanical and chemical methods of controlling locust hoppers are discussed. Spraying with sodium arsenite at the rate of 3½ oz. (containing 80 per cent. arsenious oxide) to 4 gals. water is the standard method employed in Southern Rhodesia [*R.A.E.*, A, xxi, 219]. Thorough drenching with a non-poisonous spray prepared by dissolving 1 lb. soap in 3 gals. water kills the early instars, but its use against the hoppers of *Nomadacris septemfasciata*, Serv., which do not congregate into large bands until a week or more after hatching, may be uneconomical. Baits of ground maize cobs moistened with a solution of 3 oz. sodium arsenite to 2½ gals. water were successful only in dry weather. Dusting with sodium arsenite from perforated tins is not recommended, owing to the fact that during the wet season, when hoppers of *N. septemfasciata* are present, the air is still and so moist that the dust becomes clogged. Precautions to be taken when using sodium arsenite are described, and antidotes for arsenical poisoning of cattle and man are given. The banging of tins, the waving of brightly coloured flags and the release of smoke screens [xxi, 366] are recommended for driving off swarms of adults.

The second paper records that, in September and October 1932, immature swarms of *Locusta migratoria migratorioides*, R. & F., flew before a north-easterly wind across Southern Rhodesia and covered as much as 33 miles in a day. In November, some mature swarms appeared, and numerous swarms of *N. septemfasciata* began to pour into the Colony from the north. The latter started to oviposit in December, the eggs being laid in scattered patches in soft soil. An account is given of observations on its biology, and all its stages are described [*cf.* xxi, 643]. The hoppers, which began to hatch in January, were not very active, preferring to rest in the shade of plants with dense foliage, such as *Rhynchelytrum roseum* and *Eleusine indica*, on which they also fed. Maize, which was preferred to many grasses, was severely damaged, as also were ground-nuts. Cotton, tomato, cabbage and turnip were sometimes attacked, but not lettuce, spinach, beans, leeks, onions or tobacco. The adult stage was reached in April,

and the young adults first circled about in small swarms, which gradually coalesced into larger ones. During the dry season, the swarms tended to concentrate in the more humid lower parts of the country. They were very voracious and attacked a much greater variety of plants than the hoppers, including tobacco and various fruit trees.

Sometimes as many as 95 per cent. of the eggs were destroyed by *Stomatorrhina lunata*, F., but on the whole the value of this fly was negligible. They were also attacked by mites, Coleopterous larvae and eelworms. Threadworms were found in the last hopper instars and in adults, and red mites on the wings and bodies of the latter.

It is suggested that the eastern border of Southern Rhodesia may be a permanent breeding-place of the solitary phase, some adults of which were collected there in 1915 (and apparently also in 1933), although the last known swarm south of the Zambesi had disappeared in 1910.

JACK (R. W.). **The Locust Invasion of Southern Rhodesia, 1932–33.**—*Rhod. Agric. J.*, xxx, no. 10, pp. 844–859, 1 map, 1 ref. ; also as *Bull. Minist. Agric.* [*S. Rhod.*], no. 906, 16 pp., 1 map, 1 ref. Salisbury, S. Rhodesia, October 1933.

An account is given of the invasions of Southern Rhodesia since 1909 by *Locustana pardalina*, Wlk., *Locusta migratoria migratorioides*, R. & F., and *Nomadacris septemfasciata*, Serv. In 1930, at least one swarm of *Nomadacris* crossed into the Colony from Northern Rhodesia. In September–October 1932, swarms of *Locusta* from the north-east flew right across the Colony to Bechuanaland, and in December, further swarms of both species made their appearance and began to breed, the hoppers of *Locusta* appearing in December and those of *Nomadacris* in January 1933 [see preceding paper and *R.A.E.*, A, xxi, 219]. A considerable amount of damage was caused to the crops, but a great deal more was prevented by a locust campaign, the organisation and methods of which are described [*loc. cit.*]. It involved an expenditure of £12,000 ; the total number of spraying pumps used was 4,042, and the amount of sodium arsenite provided was equivalent to 240,000 lb.

ISAAC (P. V.) & MISRA (C. S.). **The chief Insect Pests of Sugarcane and Methods for their Control.**—*Agric. Live-stock India*, iii, pt. 4, pp. 315–324, 2 pls. Delhi, July 1933.

Notes are given on the habits of the more important insect pests of sugar-cane in India (in certain districts of which at least 60 per cent. of the crop is lost annually owing to infestation by insects) and on measures for their control.

The larvae of *Asamangulia cuspidata*, Maulik, hatch from eggs laid singly in the tissues of the leaves, in which they mine and pupate. This Hispid has 3–4 generations a year and is most active in northern Bihar during June–August. *Pyrilla pusana*, Dist., *P. aberrans*, Kby., and *P. perpusilla*, Wlk., reach their maximum in August–October [*R.A.E.*, A, v, 557]. The eggs are highly parasitised, particularly during November–December [*cf.* xviii, 28 ; xx, 101]. The winter is passed chiefly in this stage (usually under sheathing leaves), though small numbers of adults may be present. The nymphs and adults

suck the juice from the leaves, the former maturing in about 2 months.

On cane planted in February, *Pseudococcus saccharifolii*, Green, and *Trionymus sacchari*, Ckll., become numerous in July, though in some localities, especially on loamy soils and when rainfall is slight, they appear as early as June. The females hibernate in ratoon cane or in the trash. *Pseudococcus* is found on the leaf-blades and the upper part of the leaf-sheaths, but *Trionymus* invariably remains under sheathing leaves. Infested plants become stunted and generally turn yellow. In infested localities, the setts should be dipped in an emulsion of 2 pints crude oil in 4 gals. water and dried for at least 24 hours before planting. Infestation by *Aleurolobus barodensis*, Mask. [*cf.* ix, 70; xviii, 28] occurs from the beginning of April and is most marked during August–September. Heavily infested leaves turn brown and wither and are covered with a sooty fungus growing on the honey-dew exudations of this Aleurodid.

Termites cause severe damage by attacking the roots of young cane, causing dead-heart and eventually killing the plant. They are particularly injurious during April–October, especially in sandy or loamy soils, where it is hard to distinguish the damage they do from that caused by *Emmalocera depressella*, Swinh. Their subterranean galleries extend for long distances. Two or three times during April–June, crude oil emulsion (rather more than a gallon per acre) should be applied to the irrigation water [*cf.* xv, 173] in small gunny bags, the bottom of which should touch the water in the channels. The emulsion is thus carried to the roots of the cane, which it protects for some time. Soils containing more clay than sand should be preferred for planting.

The eggs of *Scirpophaga nivella*, F., are laid in clusters on the leaves and hatch in 10–12 days. The larvae migrate to other plants, in which they tunnel from the top through 4–5 nodes, causing the death of the central shoot in the young ones. The pupal period is passed in the tunnel and occupies 10–12 days. Pairing occurs on the first night after emergence and oviposition on the second. Both sexes are attracted to strong light [but *cf.* xix, 513]. There are usually 5–6 overlapping generations (each occupying 45–50 days) during the period of activity, which is at its maximum during April–October.

Argyria sticticraspis, Hmps., *Chilo zonellus*, Swinh., and *Diatraea venosata*, Wlk., which is the least injurious, lay several clusters of about 20 eggs at night [*cf.* xviii, 28], chiefly on the lower surface of the leaves and generally near the mid-rib. The larvae feed first on the leaves and then penetrate the stem, preventing the circulation of the sap and causing dead-heart, the damage being similar in the young canes to that caused by *S. nivella*. When the plants are 3–4 ft. high, the larvae tunnel 3–4 ins. in the top, and then migrate to other stems. They pupate within 3 or 4 weeks, emergence occurring after a few days. The life-cycle from oviposition to emergence occupies about 5–6 weeks in the hot season. Larvae feeding in autumn (October–November) remain more or less dormant in the stems throughout the winter and pupate with the warm weather, though a few individuals may hibernate as pupae. Only setts that are well developed and free from infestation by these stem-borers or by mealy-bugs should be planted.

Emmalocera depressella is more abundant in some localities than others, but has recently spread to the greater part of the cane-growing areas, being responsible for serious damage during April–September.

The eggs are laid singly on the leaves at night and hatch in 4 days [xviii, 28]. The larvae burrow in the base of the stem of young seedlings, causing dead-heart like *S. nivella*. Pupation often occurs in the shoot above ground level, the life-cycle lasting 56–69 days. Adults of this root-borer and of the stem-borers may be trapped on dark nights by hurricane lanterns hung over pans of water covered with a film of kerosene.

The control measures recommended consist chiefly of the removal and destruction of infested plants or leaves, hand-collection of the appropriate stages of the various pests, clean cultivation between one crop and the next, and the avoidance of ratoon crops.

RAMAKRISHNA AYYAR (T. V.). **Some important Insect Problems connected with the Cultivation of Rice in South India.**—*Agric. Live-stock India*, iii, pt. 4, pp. 341–351, 7 pls., 4 refs. Delhi, July 1933.

A brief general account is given of the problem presented by insect pests of rice in southern India, followed by notes on the bionomics and control of eight more serious ones and brief references to several others that are of minor importance. They may cause considerable damage annually, particularly where the growing of three successive crops year after year enables them to breed continuously. The stage of the plant at the time of infestation and the distribution and seasonal incidence of various species are illustrated.

Spodoptera mauritia, Boisd. [*cf. R.A.E.*, A, xx, 560, etc.] is the most important and is distributed throughout the rice-growing areas. One generation occupies 30–40 days. The larvae, especially if brought to the surface by flooding, are readily eaten by ducks and other insectivorous birds. They may also be swept into baskets or hand-nets and destroyed, or, where a high percentage of parasitism is observed, they may be placed in cages and the emerging parasites liberated in the field. Dusts of calcium arsenate have occasionally proved effective.

Hieroglyphus banian, F., is particularly injurious in submontane regions and especially in low-lying swampy areas where the rice is broadcast. The egg-pods are laid in the soil during October–November, but do not hatch until the monsoon rains in June–July. The hoppers feed on the grasses, etc., on the field bunds before the rice comes up, and the adults on the leaves, shoots and ear-heads of the rice. There is one generation annually. The young hoppers may be collected from the field bunds in bags or nets and the older ones driven into a corner and killed by beating with sticks. The egg-pods may be destroyed by scraping the bunds and ploughing the field during the early summer [*cf.* xxi, 552], and those about to hatch may be killed by trimming the bunds before the puddling immediately after the first rains.

The Pyralid, *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.), is occasionally injurious, the larvae boring into the stems and causing the death of the central shoot in young plants or of the entire ear-head in mature ones. The life-cycle occupies about 4–5 weeks. In nurseries, the egg-masses on the young foliage and also the dead-hearts should be collected and removed before transplanting. Large numbers of gravid females have been caught in light-traps. Where possible, the

stubble, in which the larvae and pupae remain after harvest, should be ploughed up and destroyed [*cf.* xviii, 463].

Hispa armigera, Ol., may cause severe damage by mining in the young leaves. The beetles may be collected in numbers with hand-nets in nurseries, and flooding will bring them to the surface, where they may be swept up and destroyed. Spraying or dusting with lead or calcium arsenate has been found effective on valuable plots. The immature stages of this Hispid and the egg-masses of *S. bipunctifer* may be destroyed by clipping the tops of the seedlings before transplantation.

The Coreid, *Leptocorisa acuta*, Thnb. [*cf.* xvii, 112 ; xix, 296], is of chief importance along the western coast. The larvae of the Pyralid, *Nymphula depunctalis*, Gn., attack the foliage of young rice plants, generally in swampy fields. They make tubular cases of short lengths of the leaf-blades and are semi-aquatic, being able to breathe under water. They may be controlled by oiling the water with a film of kerosene and dislodging the cases by passing ropes over the plants. *Ripersia oryzae*, Green [xix, 416] stunts and weakens the growth of rice by sucking the sap from the succulent stem under the outer sheathing leaves. Destruction of grasses is of value against this Coccid, *Spodoptera mauritia*, *L. acuta* and *Pachydiplosis oryzae* Wood-Mason [*cf.* xi, 256 ; xvi, 302].

CORBETT (G. H.) & MILLER (N. C. E.). **A List of Insects with their Parasites and Predators in Malaya.**—*Sci. Ser. Dept. Agric. S.S. & F.M.S.*, no. 13, 15 pp. Kuala Lumpur, 1933. Price *Cts.* 50.

In this list, compiled from records obtained in the entomological laboratory from 1920 to 1932 [*cf. R.A.E.*, A, xvii, 413], the parasites and predators are arranged systematically, followed by the name, family and food of the host or prey.

CORBETT (G. H.). **Division of Entomology. Annual Report for the Year 1932.**—*Gen. Ser. Dept. Agric. S.S. & F.M.S.*, no. 14, pp. 39–52. Kuala Lumpur, 1933.

Many of the pests observed in Malaya during 1932 have already been noticed [*R.A.E.*, A, xx, 398, 557 ; xxi, 26, 205, 573]. The first outbreak for 12 years of the Limacodid, *Chalcocelis albiguttata*, Snell., on coconut occurred in the spring of 1932. The eggs were laid chiefly on the lower surface of the leaflets. The larvae fed for about 5 weeks on the epidermis, afterwards devouring the entire tissue for about 4 more weeks. At the beginning of the outbreak, they were confined to the older leaves, but eggs were subsequently laid on the younger ones. Withering of the leaves by the fungus, *Pestalozzia palmarum*, following surface injury by the younger larvae, probably caused more damage than direct feeding. A Tachinid and two unidentified Hymenoptera were bred from the larvae, and the Tachinid, *Exorista cervinioides*, Wulp, a Bombyliid, *Systropus* sp., two unidentified Chalcidoids and one Ichneumonid from the cocoons. A bacterial and a fungous disease appeared to cause considerable mortality among the larvae and pupae respectively.

Pests of copra [*cf.* xx, 600] included : *Carpophilus dimidiatus*, F., *Cathartus* (*Silvanus*) *advena*, Waltl, *Necrobia rufipes*, DeG., *Laemophloeus pusillus*, Schönh., *Palorus subdepressus*, Woll., *Psoquilla*

marginepunctata, Hag., and the mite, *Rhizoglyphus* (?) *callae*, Oudm., all of which feed and oviposit mainly on wet or mouldy copra or on fungous growths upon it.

Investigations into the bionomics and control of the Bostrychids, *Sinoxylon anale*, Lesne, *Xylopsocus capucinus*, F., and *Dinoderus minutus*, F., both larvae and adults of which bore into dried roots of *Derris* [*cf*. xix, 647], are in progress. Other insect pests occurring in Malaya in 1932 included *Microtermes pallidus*, Hav., *Thosea lutea*, Heyl., *Zeuzera coffeae*, Nietn., *Gracilaria theivora*, Wlsm., the Thyridid, *Striglina glareola*, Feld., the Dynastid, *Chalcosoma atlas*, L., and the mite, *Brevipalpus obovatus*, Donn., on tea; *Hidari irava*, Moore, and *Amathusia phidippus*, L., on coconut; *Setora nitens*, Wlk., on oil palm [*Elaeis guineënsis*]; *Patanga succincta*, L., on rice; *Margaronia marginata*, Hmps., on gambier [*Uncaria gambier*]; *Stauropus alternus*, Wlk., on gutta-percha [*Palaquium*]; and *Pyrausta salentialis*, Snell., on maize. The Pentatomid, *Cantheconidea furcellata*, Wolff, was recorded as predacious on *Artona catoxantha*, Hmps., and *Scolia vollenhoveni*, Sauss., as a parasite of the larvae of *Protaetia fusca*, Hbst., a Cetoniid that feeds upon the male flowers of the coconut inflorescence.

HART (P. C.). **Voorkomen en verspreiding van de parasieten van den witten topboorder.** [The Occurrence and Distribution in Java of the Parasites of the White Tip-borer of Sugar-cane.]—*Arch. Suikerind. Ned.-Indië*, 1933, pp. 731–801; *Meded. Proefst. Java Suikerind.*, 1933, no. 16. Surabaya, 1933.

A detailed account is given of an investigation made in 1931 to ascertain the value of parasites in the control of *Scirpophaga intacta*, Sn., on sugar-cane in Java. Previous records are discussed from the literature. Of the egg-parasites, *Phanurus beneficiens*, Zhnt., *Tetrastichus schoenobii*, Ferrière [*R.A.E.*, A, xix, 538] and *Trichogrammatoidea* (*Trichogramma*) *nana*, Zhnt., the first-named was of far greater importance than the only noteworthy larval parasite, *Elasmus zehntneri*, Ferrière [xviii, 198] and the pupal parasite, *Eripternimorpha javensis*, Roh. [vii, 104]. There was a balance between it and the tip-borer [*cf*. xxi, 422], the same conditions favouring both. A low percentage of parasitism results either from a scarcity of host egg-masses, such as occurs in very dry districts [xix, 568] or where intensive measures have been practised against the borer, or from an abundance of egg-masses following a period of egg (and parasite) scarcity. An intensive campaign against the borer is thus followed by a prolonged period with a low percentage of parasitism. *T. nana*, of which several individuals developed in one host egg, was very scarce and of no practical value. *Tetrastichus schoenobii* was more abundant, but though present everywhere, it usually occurred only sporadically in the borer egg-masses and then often in association with *P. beneficiens*, of which it may be regarded in many respects as a competitor. The percentages of parasitism by *Elasmus zehntneri* and *Eripternimorpha javensis*, which were noted in a very large number of localities, were usually so low as to confirm the negligible part played by them. It is concluded that parasites are useful in reducing the numbers of the borer, but are incapable by themselves of providing a sufficient check upon it.

ZECK (E. H.). **Investigations on the Green Vegetable Bug** (*Nezara viridula* **Linn.**).—*Agric. Gaz. N.S.W.*, xliv, pts. 8–9, pp. 591–594, 675–682, 2 pls., 2 figs., 2 refs. Sydney, 1st August–1st September 1933.

The first paper deals with the bionomics of *Nezara viridula*, L., in New South Wales, where it was first recorded in 1916 [*R.A.E.*, A, v, 6] and is now found over an area of 50,000 sq. miles. It is a pest also in Queensland [xx, 156] and Western Australia [xiv, 364], but not in South Australia or Victoria. Young bean pods are frequently injured, becoming shrivelled and distorted. Tomatos become mottled and discoloured. Other food-plants in New South Wales include vines, maize, cucurbits, oranges, passion fruit [*Passiflora*], potatoes, and spinach.

When infested plants were disturbed, the bugs dropped to the ground [xiv, 365] or rested upon the lower parts of the plant. The first eggs were laid by overwintered females about the middle of September, and the last by the third brood in late April. Hibernating adults of the brown form, which is common in the cooler months, were found in one district during June, sheltering under the bark of *Eucalyptus*. The eggs were usually laid in compact clusters in regular parallel rows ; one female laid four clusters, totalling 227 eggs, over a period of 52 days. Females began to oviposit 39–81 days after reaching the adult stage. The normal incubation period was 5–8 days, and the five nymphal instars totalled 34–53 days, with one instance of 63. Longevity experiments showed that adults of both sexes can survive for six months or more, even if exposed to severe winter conditions, though the rate of winter mortality is high.

The second paper includes descriptions of all stages and notes on laboratory experiments with 44 different contact sprays and dusts, applied direct to adult bugs in a wire-gauze cage. Oil sprays containing resin and caustic soda gave the best control, but injured the foliage. Pyrethrum dust with or without an equal quantity of 2½ per cent. nicotine dust, gave the most promising results, killing 8 out of 16 and 4 out of 10 respectively. Practical control measures recommended are : clean cultivation and destruction of all plant refuse ; spraying of late crops, in which the adults may overwinter, with pure kerosene ; hand-collection of egg-clusters during summer and of adults on their first appearance ; and the application to the plants, and then to the surface of the soil, of a pyrethrum or pyrethrum-nicotine dust.

MAGEE (C. J.). **Etiology of the Chocolate Spot Disease of Broad Beans.** —*Sci. Bull. Dept. Agric. N.S.W.*, no. 43, 8 pp., 2 pls., 9 refs. Sydney, August 1933.

An account is given of observations and experiments in New South Wales, which showed that " chocolate-spot disease " of broad beans (*Vicia faba*) is not caused by bacteria as previously believed, but is due to the reaction of the plant to the deposition of honey-dew by *Aphis rumicis*, L., and to a less extent by *Myzus persicae*, Sulz. Dark-red to reddish-brown spots 1–5 mm. in diameter are formed, mostly on the leaves and particularly on the upper surface. The majority are only surface blemishes and appear to have little effect on the vitality of the plant. Certain fungi have been responsible for much of the loss attributed to chocolate-spot in the past. The

honey-dew does not appear to form a medium for the growth of pathogenic organisms, examination and isolation revealing only saprophytic species.

FRENCH (C.). **New Records of Plants attacked by native Insects.**—*Vict. Nat.*, 1, no. 5, p. 119. Melbourne, September 1933.

In continuation of a series [*cf. R.A.E.*, A, xxi, 569], notes are given on the Cossid, *Zeuzera eucalypti*, Boisd. The original food-plant of the larvae in Australia is *Acacia*, particularly *A. decurrens* and *A. longifolia*, but they have recently been found in peach, apricot and plum trees. The eggs are laid in cracks in the bark, and the larvae mine in the wood, where they may remain for 2–3 years. So many of the moths on emerging are destroyed by birds and ants that they are unlikely to become a serious pest of orchards.

MELIS (A.). **Contributo alla conoscenza dello** *Sphaeroderma rubidum* **Graëlls. Breve descrizione della specie e distribuzione geografica per l'Italia.**—*Redia*, xx, pp. 189–228, 13 figs., 2 pls. Florence, 5th October 1933.

The Halticid, *Sphaeroderma rubidum*, Graëlls, all stages of which are described in considerable detail, has one generation a year in Italy. The larvae hibernate in earthen cells about an inch beneath the surface of the ground, close to artichokes (*Cynara scolymus*) on which they have fed, and pupate in March. The adults emerge in spring and at once begin to feed on the leaves; after about a week, they retire to the shelter of neighbouring herbaceous plants or bushes, where they aestivate. In September, with the first autumn rains, they return to artichokes and feed on the leaves, on which, after pairing, the females oviposit. The larvae hatch in 3–4 days and immediately begin to mine in the leaves. They remain in the mines for two months, after which they descend to the ground for hibernation. While artichoke is the preferred food of the adults, they also attack thistles and other composites. The injury done in spring is unimportant, but that caused by the adults and larvae in autumn is serious and sometimes leads to total loss of a crop. The only natural enemies observed were *Silpha olivieri*, Bedel, and the Carabids, *Harpalus siculus*, Dej., *Pterostichus gisellae*, Csiki (*crenatus*, Dej.) and *Calathus circumseptus*, Germ., which were predacious on the larvae and pupae. The adults may be jarred off the plants into trays containing water, and if the larvae are abundant in small areas, infested leaves may be collected. An arsenical spray has been found to give good results, but cannot be safely used except in spring. Two applications, with a few days' interval, of a 1 per mille nicotine sulphate spray has been found to destroy nearly all the larvae in their mines.

DESHUSSES (J.) & DESHUSSES (L.). **Insectes nuisibles aux cultures. I. Cas nouveaux ou peu connus de parasitisme.**—*Mitt. schweiz. ent. Ges.*, xv, no. 11, pp. 474–486, 2 pls. Berne, 15th June 1933. [Recd. October 1933.]

Several of the insect pests here recorded from Switzerland have already been noticed [*R.A.E.*, A, xvii, 404; xx, 384, etc.]. The Tortricid, *Argyroploce antiquana*, Hb., is a serious pest of the Chinese artichoke, *Stachys sieboldi* (*affinis*) [xix, 586], the larvae mining in the

rhizomes. In 1930, they began to leave the rhizomes about 25th April, and by the end of the month half of them had spun silken cases a little below the surface of the ground. The first adults appeared on 6th June. The eggs were laid on the aerial parts of the plants, and many larvae mined in the terminal shoots before descending to the rhizomes. Of 200 larvae collected in the field, 3 were parasitised by a Braconid, *Ascogaster canifrons*, Wesm. Considerable injury was caused by the galls formed on box [*Buxus*] by *Monarthropalpus buxi*, Lab., and on raspberry by *Lasioptera rubi*, Heeg. The sawfly, *Euura atra*, Jur., mined in the pith of willow, rendering the twigs useless for basket-making.

HADORN (C.). **Recherches sur la morphologie, les stades évolutifs et l'hivernage du bostryche liseré** (*Xyloterus lineatus* **Oliv.**).—*Thèse Éc. polyt. Zurich.*, no. 761, 120 pp., 77 figs., 3 graphs, 53 refs. (*Beih. Z. schweiz. ForstVer.*, no. 11.) Berne, 1933. (With a Summary in German.)

This monograph is based on field and laboratory studies of *Xyloterus lineatus*, Ol., carried out from the autumn of 1931 to May 1933 in and near Zurich, where it is an important pest of seasoning coniferous timber stacked in saw-mills and timber yards, of the commercial value of which it causes a considerable depreciation.

Separate chapters deal with the systematic position, synonymy and distribution of this Scolytid ; morphology of all stages and adult anatomy ; bionomics ; nature of injury ; and economic importance.

Detailed investigations among stacked timber in a forest and a yard showed that hibernation occurs in the adult stage below the cover of dry leaves and twigs in the upper friable layer of the soil, which is usually composed of fragments of leaves, humus, etc., at a depth of 2–5 cm. and within about 33 yds. of the focus of infestation, the beetles being especially abundant at distances of 6–14 yds. There is only one annual generation, the whole life-cycle from egg to adult being completed in 6–10 weeks, of which the egg-stage occupies 5–10 days, the larval 3–6 weeks, and the pupal 8–10 days. On the Swiss plateau, the flight of the beetles usually begins at the end of March, its duration being to a large extent dependent on weather conditions. The behaviour of the adults, boring of the galleries, oviposition, and the growth of the ambrosia fungus, which is the sole food of the adults and larvae [*cf. R.A.E.*, A, xiii, 484], are discussed at length. Observations indicated that the females carry in their body the spores of the fungus, which they cultivate on the walls of the oviposition tunnel. Before the appearance of ambrosia in the gallery, the digestive tract of the beetles has invariably been found to be empty. The tunnels are bored by the female, while the male closely follows her and ejects the frass. The eggs are laid singly in small cells and covered with a thin layer of frass. The number of eggs laid by a female in seven cases observed varied from 14 to 52. Boring ceases after oviposition is over, but the adults remain in the galleries and keep them clean by removing the larval excreta ; they abandon the colony only when the last larva has pupated. The larvae remain in their cells, feeding on the ambrosia fungus ; as they grow, they enlarge the cells by gnawing. Pupation occurs in the cells.

On emergence, the adults first make their way out into the gallery; they then return to the cells to feed on the ambrosia that has developed

on the walls during the pupal period. Cases of cannibalism have been observed. In breeding experiments, the first adults emerged on 27th June, but did not abandon the galleries till 24 days later. The beetles probably enter hibernation shortly after abandoning the timber, and do not become active during the warm weather in September and October. The author suggests that the colonies found by other investigators as late as August-November and believed by them to represent a second generation were in fact late colonies founded by females that had been disturbed in their boring and oviposition in the spring, or had been compelled to leave the galleries unfinished when the timber became dry as a result of exposure to the sun [*cf.* vii, 1]. In repeated experiments, the beetles were not able to penetrate into standing trees or recently felled timber, but readily attacked trunks that had been felled in October–January or barked timber felled in December–January. They always preferred wood stacked on the soil, without supports and in damp and shady places, as these conditions favour the growth of the ambrosia in the galleries.

As a preventive measure, the trunks should be barked immediately after felling [vii, 1], and to insure complete protection the outer logs of a stack should be sprayed with 8–10 per cent. tar distillate (carbolineum) [*cf.* xix, 588] shortly before the spring emergence, or when the first heaps of frass ejected by the adults are observed, the repellent effect of this treatment lasting 4–6 weeks, that is during the whole flight period. The adults may be killed before the fall of the snow or at the end of winter by raking together the litter in which they hibernate and burning it or spraying it with 10 per cent. tar distillate, and during the active period by spraying the infested trunks (when the galleries are only about an inch deep) with 10 per cent. tar distillate, or (at a later stage) with " Xylamon hell " [*cf.* xxi, 323]. On the death of the adults, the larvae will be killed by the accumulation of excreta in the galleries.

The Gamasid, *Laelaps agilis*, Koch, was often found attached to larvae, pupae and adults of the Scolytid, apparently feeding on the body-fluids, but was of no value in their control.

WIESMANN (R.). **Untersuchungen über die Lebensgeschichte und Bekämpfung der Kirschfliege** *Rhagoletis cerasi* **Linné. I. Mitteilung.** [Investigations on the Life-history and Control of the Cherry Fly. First Communication.]—*Landw. Jahrb. Schweiz*, xlvii, no. 7, pp. 711–760, 27 figs., 49 refs. Berne, 1933. (With Summaries in German and French.)

The serious outbreaks of *Rhagoletis cerasi*, L., on cherry that have occurred in Switzerland since 1930 led to investigations in 1932, which are here described in detail.

The following is taken from the author's summary : The morphology and biology of the fly are studied, and an account is given of the biology as observed in nature and in the laboratory. Under favourable conditions, the adult life of males averages 23 days and that of females 30–31 [*cf.* *R.A.E.*, A, xxi, 525]. The pre-oviposition period averages 11 days at 18–20°C. [64·4–68°F.]. The ovaries of unfed females do not develop, a diet of carbohydrates (primarily secretions on the leaves and twigs of cherry) being necessary. Oviposition in the cherry pulp is described ; it only occurs above about 18°C. [64·4°F.]. One female lays an average of 50–60 eggs, with a maximum of 100. In 1932, the

flies were emerging from 28th May to 8th July and had a total flight period of 60 days. The effect of meteorological conditions is discussed in detail. Under favourable ones, the flies are fairly active, but rarely fly further than 60 ft. The egg-stage lasts 6–12 days, and the larval averages 30. Larvae from eggs laid in green cherries cannot survive. Most of the larvae can be destroyed by early picking. The period during which the larvae are leaving the fruit and entering the soil to pupate lasts at least 12–14 days, so that any soil fumigant or other insecticide used against them in this stage would have to remain toxic for about a fortnight. Pupation usually occurs about $1\frac{1}{5}$ins. below the surface. More than 10 pupae per sq. ft. may be found under heavily infested trees, but if the crop has been harvested at the right time, only a few occur. The thermal constant [*cf.* xiii, 389] of pupal development in spring is 195 day-degrees C. [351F.], with 10°C. [50°F.] as the threshold of development [*cf.* xx, 235]. To attain normal development, pupae must pass through a fairly long inactive period in the cold ; in a heated laboratory they produce adults only after 2 years, and a certain (probably variable) percentage have a 2-year cycle in nature [xx, 78]. Within 2 hours of emergence, the adults take their first meal, largely water.

From 138 pupae, 34 adults of an Ichneumonid, *Phygadeuon* sp., were obtained. A fungus, *Empusa* sp., attacking the adults, is of negligible importance.

No soil fumigant tried gave good results against the pupae [*cf.* xx, 538]. Of contact insecticides, quicklime and caustic soda were ineffective, and sulphuric acid was effective only at high concentrations. Good results were obtained with kerosene, which, however, injured the trees, and with some tar-distillates, of which the best was crude pyridine. In trials with heat, it was not possible to obtain the requisite temperature of 55°C. [131°F.] at a sufficient depth in the soil. The removal of the turf, which is then stacked in heaps and treated with kerosene or other suitable material, appears to be a cheap and effective measure. Bait-sprays tested against the adults were ineffective on account of the rainy weather in 1932.

Kruimskiĭ nauchno-issledovatel'skiĭ Institut Zashchitui Rasteniĭ. [Crimean Sci. Res. Inst. Plant Prot.], Listovki [Leaflets] no. 2, 4 pp. ; no. 3, 8 pp., 6 figs. ; no. 9, 7 pp., 5 figs. ; no. 10, 8 pp., 9 figs. ; no. 11, 6 pp., 2 figs. ; no. 12, 12 pp., 7 figs. Simferopol, 1932–33. [Recd. October 1933.]

Of these popular leaflets, which are intended for use on Soviet farms in the Crimea, nos. 2 and 10, by Ya. V. Chugunin, contain instructions for the control of orchard weevils by jarring [*R.A.E.*, A, xxi, 634]; no. 3, by E. Novopol'skaya, describes measures to be applied in spring against insect pests of fruit trees ; no. 9, by N. Mikhailovskaya, comprises a general account of injurious grasshoppers and their control ; and no. 12, by Chugunin, outlines the organisation of a campaign against *Loxostege sticticalis*, L., in view of the possibility of an outbreak in 1933 [*cf.* xxi, 620].

Leaflet no. 11, by A. L. Indichenko, deals with *Otiorrhynchus asphaltinus* Germ., which is an important pest of vines in the Crimea [xv, 342, 511]. The larval and pupal stages are passed in the soil, and both larvae and adults overwinter, the latter under dry leaves or lumps of earth. The principal damage is caused by the overwintered weevils in spring,

when they destroy the buds and developing shoots of the vines. Experiments in 1932 showed that they may be controlled by dusting with calcium arsenate (7–9 lb. to the acre), or by spraying with 2·5 per cent. barium chloride. The vines should be dusted at the end of April or beginning of May against the overwintered adults on the bursting buds, and again at the end of June and the end of July or beginning of August, when the newly emerged weevils are feeding on the leaves before entering hibernation. In summer, Paris green and lime (1 : 7) may be substituted for calcium arsenate.

[GORBAN' (S. E.) & KHERSONSKAYA (E. A.).] **Горбань (С. Е.) и Херсонская (Е. А.). The Control of Diseases and Pests of Vegetable Seedlings in the Crimea.** [*In Russian.*]—20 pp., 5 figs. Simferopol, Kruimsk. nauch.-issled. Inst. Zashch. Rast. [Pub. Crimean Sci. Res. Inst. Plant Prot.], 1933.

A section of this paper is devoted to insect pests of vegetable seedlings observed in greenhouses and in the field in the Crimea in 1932, the popular names only being given. They include *Plutella maculipennis*, Curt., *Barathra brassicae*, L., *Brevicoryne brassicae*, L., and *Ceuthorrhynchus quadridens*, Panz., on crucifers, and weevils on beet, as well as flea-beetles [*Phyllotreta*], wireworms, cutworms, Tenebrionids, Melolonthids and *Gryllotalpa gryllotalpa*, L. The usual measures are recommended for their control.

[LI (Feng-Swen).] **Pink Boll Worm** (*Pectinophora gossypiella* **Saunders).** [*In Chinese.*]—*Ent. & Phytopath.*, i, no. 11, pp. 240–250, 1 chart ; no. 12, pp. 260–266, 1 chart ; no. 13, pp. 288–298, 3 figs., 21 refs. Hangchow, China, April & May 1933. (With a Summary in English.)

Platyedra (*Pectinophora*) *gossypiella*, Saund., has two generations a year at Shanghai and requires about 48 days to complete its life-cycle. The pupal period of the resting-cycle larvae is much longer than that of the summer brood. It is the most destructive cotton pest in China, injuring the flower-buds, flowers, bolls and squares, and seriously affecting the strength, weight and grade of the cotton fibre. In 1931, it was responsible for a loss of approximately £5,000,000, with an average of 24s. an acre. The usual methods of control are recommended, particularly those designed to destroy the resting-cycle larvae.

MURRAY (G. H.). **Notes on the Coconut Grasshopper or Long Horned Tree Hopper** (*Sexava* **sp.**).—*Leafl. New Guinea Dept. Agric.*, no. 69, 4 pp. Rabaul [? 1933].

A Tettigoniid, *Sexava* sp., is becoming an increasingly serious pest of coconuts in the Territory of New Guinea, causing an annual loss estimated at 10,000 tons of copra or £100,000. The following information is largely based on a progress report by N. E. H. Caldwell on work carried out in the Admiralty Islands.

The eggs are usually laid in the ground or in epiphytic growths on the trunks of the palms, but also, in some districts, in the crowns or in shallow holes in the trunks. Immediately upon hatching, the nymphs ascend the nearest tree. The mortality in the first instar

apparently determines the rate of increase (which was not strikingly rapid), so that there is a greater chance of control if the nymphs are hand-collected as soon as they appear. The adults feed at night and on dull days, usually sheltering by day on the lower surface of the leaflets towards the base. Five species of birds feed on the larger nymphs and adults. Hand-collection is the most satisfactory method of control at present. It is apparently not more effective by night than by day. On young palms, the grasshoppers may be dislodged by hand or with short sticks ; on palms 10–25 feet high, long, light sticks with tufts of coconut leaves tied to the end may be used. From taller palms, they may be dislodged by fires, which are most effective when there is a slight breeze. Their effect depends on heat, not on smoke, and they are useless if the trees are very tall An attempt is being made to introduce from Amboina a Hymenopterous egg-parasite that attacks another species of *Sexava* there [*cf. R.A.E.*, A, xvi, 130].

BREDO (H. J.). **Note sur** *Argyroploce leucotreta* **Meyr.**—*Bull. agric. Congo belge*, xxiv, no. 2, pp. 150–156, 2 figs., 4 refs. Brussels, June 1933. [Recd. October 1933.]

Argyroploce leucotreta, Meyr., which has been known for 30 years as a pest of *Citrus* in South Africa [*R.A.E.*, A, ix, 442 ; xvi, 62, etc.], has become widely distributed and injurious on cotton in the Belgian Congo. All stages are described, and the characters distinguishing it from *Platyedra gossypiella*, Saund., with which it has been sometimes confused, are given. The eggs are laid singly, generally at a slight distance from each other [xiv, 325]. In the Belgian Congo, there are not many annual generations of this Tortricid ; in cotton fields, where it had been abundant in July, it had practically vanished by the end of September. The injury to cotton is similar to that caused by *P. gossypiella*. The larva enters the boll through a small entrance hole and attacks all the seeds in the first locule before passing into the next, sometimes ultimately destroying them all. The empty pupa case is usually found on the surface of the boll, whereas that of *P. gossypiella* is generally inside the seeds where pupation has taken place. The comparative percentage of injury to cotton caused by *A. leucotreta* and other cotton pests in Nigeria in 1925 is quoted [xiv, 324], and its relative importance among pests on cotton in different localities in the Belgian Congo is indicated. It was mainly responsible for halving the yield of one plantation that had produced 282 tons the previous year. Parasitism to the extent of 10–15 per cent. by a Braconid, *Chelonus* sp., was sometimes observed.

BREDO (H. J.). **Note sur un insecte destructeur des** *Maesopsis eminii* **Engl.**—*Bull. agric. Congo belge*, xxiv, no. 2, pp. 157–161, 3 figs. Brussels, June 1933. [Recd. October 1933.]

Injury to *Maesopsis eminii* in the botanical gardens at Eala, Belgian Congo, the trunks of which were observed to break off sharply at a uniform height of about 13–16 ft., was found to be due to the Lamiid, *Monochamus scabiosus*, Quedenf., the adult and larva of which are described. The eggs are laid in May in crevices of the bark, apparently only on healthy trees with trunks at least 4–8 ins. in diameter. The young larvae penetrate beneath the bark and bore galleries,

which pass through both the cambium and the sap-wood. In no case has the tree been found to be completely girdled. The accumulation of frass under the bark causes noticeable swellings, along which the bark cracks vertically. Having hollowed out the bark over two-thirds of the circumference at a height of 13–16 ft., the larva enters the core of the trunk and there excavates an ascending gallery ending in the pupation chamber. The affected region becomes weakened and breaks off when exposed to wind. In April 1932, 70·2 per cent. of the trees were infested and 38·6 per cent. had been broken off. Many were infested by several larvae, and some were partly girdled both at 13 and at 16 ft. The life-cycle lasts about a year, the damage increasing steadily from June to February, and the trees usually break in December or January. Pupation occurs in March–April, the adults emerging between mid-April and mid-May.

Control measures include preventive treatment of the trunks with liquid insecticides and hand-collection of the adults in April–May. Broken trunks should be burned before the adults can emerge. Where swellings are observed, the entrance holes should be exposed by scraping the bark, and carbon tetrachloride or carbon bisulphide should be poured into them, the opening being then closed with clay. The adjacent parts should be treated with tar, which hastens the healing of the bark.

DARBY (H. H.) & KAPP (E. M.). **Observations on the Thermal Death Points of** *Anastrepha ludens* **(Loew).**—*Tech. Bull. U.S. Dept. Agric.*, no. 400, 18 pp., 10 graphs, 9 refs. Washington, D.C., September 1933.

Observations at Morelos, Mexico [*R.A.E.*, A, xvi, 260] suggested that larvae of *Anastrepha ludens*, Lw., in fallen mangoes were unable to survive direct exposure to the sun at summer temperatures. In laboratory experiments, larvae in mangoes exposed for 4 or 8 hours to 111·2°F. all died, but the mortality at 105·8°F. was only 13 and 37 per cent. respectively, although even this temperature is higher than is likely to be maintained under grove conditions for so long a period. When the survivors, which for several hours had appeared to be dead, were kept at temperatures varying from 101·5 to 107·4°F., the percentage that pupated ranged from 12·5 to 52·8, and about 75 per cent. of these pupae gave rise to adults, as compared with the normal figure of 85–90 per cent. In view of the difficulty of obtaining definite conclusions in tests with whole mangoes, which sometimes contain dead larvae at the start of the experiment and which only reach a thermal equilibrium in the incubator very slowly, larvae were also exposed in pieces of mango pulp. Under these conditions, almost all were killed in 15 hours at 104·9°F.; they were unaffected by 7 days' exposure at 37·4–41°F.

In experiments with pupae, younger ones (within 4 days of the formation of puparia) were killed at 103·1 or 104·9°F. by exposures of 10 and 7 hours respectively, whereas older ones remained unaffected. The older pupae, however, were less resistant than larvae. At somewhat lower temperatures, the results were irregular. In exposure to cold, all the younger pupae were killed at 39·6°F. in 15 days and at 49·5°F. in 30. Below the threshold of development (about 50°F.), the effects of different low temperatures are very similar; thus, at 39·6°F. for 5 and 13 days, 62 and 92 per cent. respectively of the

younger pupae were killed, as compared with 55 and 89 per cent. at 49·5°F. This fact is of great practical importance, as it is much less costly in cold-storage rooms to maintain a moderately low temperature for a longer period than very low temperatures for even a short time. Further experiments, in which pupae varying in age were exposed to 39·6°F. for from 1 to 10 days, showed that susceptibility to cold fluctuates in the course of the pupal period in a very irregular manner. A high percentage of pupae placed directly in the cold room became infected with mould, which increased with the duration of the exposure to the low temperature. The number infected, however, was less when some days had been spent at 77°F. before transfer to the cold room. Almost all adult flies were killed by exposure to 103·8°F. for 1½ hours. The differences between this and higher temperatures were small. Of flies exposed to temperatures ranging from 34·7 to 44·6°F., which are never experienced in nature in this part of Mexico, 35 per cent. died after 8 days and 98 per cent. after 15 days.

The author briefly discusses the possibility that this and other insects might be controlled by sublethal temperatures that would render the survivors incapable of reproduction.

Vansell (G. H.). **Scale Insect Honeydew from Incense Cedar.**—*Amer. Bee J.*, lxxii, no. 9, p. 364, 1 fig. Chicago, Ill., 1932. (Abstr. in *Expt. Sta. Rec.*, lxix, no. 4, p. 555. Washington, D.C., October 1933.)

This is a brief account of honey derived from the honey-dew produced by *Xylococculus macrocarpae*, Colem. (cypress scale), which infests incense cedar (*Libocedrus decurrens*) on the Pacific Coast of the United States at elevations of 2,000–7,000 ft.

MacLeod (G. F.) & Rawlins (W. A.). **Insect and other Injuries to Potato Tubers.**—*Bull. Cornell Univ. Agric. Expt. Sta.*, no. 569, 14 pp., 8 figs. Ithaca, N.Y., June 1933. [Recd. October 1933.]

Wireworms, principally *Agriotes mancus*, Say, are responsible for the most serious and widespread injury to potato tubers in New York. Larval development requires 3 years [*cf. R.A.E.*, xvii, 70], the damage being less serious in the last year, as the larvae pupate in July, though seed-pieces and young plants may be attacked. The adults emerge in the following year and are most abundant in May and June. Potato fields should be kept free from dense cover at this time, as the insects do not oviposit in soil that is bare and dry. The larval tunnels are liable to secondary infestation by *Rhizoctonia*, etc., and Mycetophilid larvae. The latter, chiefly *Sciara* sp. and *Pnyxia scabiei*, Hopk. [*cf.* xx, 523], may also act as primary pests of seed-pieces and tubers, boring cavities ¼–½ in. deep in them. Injury to potatoes by Mycetophilids or millepedes is slight if the reaction of the soil is about pH 5 [*cf.* xxi, 414]. Examinations should be made in spring and autumn, and if the pH is above 7 and free carbonates are present, it is advisable to grow potatoes elsewhere. If it is 6 or higher and free carbonates are absent, fine sulphur should be applied at the rate of 300 lb. per acre, and if it is between 5 and 6, an acid-forming fertiliser should be used. In severely infested fields, the application of manure in the year of planting should be avoided.

Fruit and Vegetable Quarantine. Amendment No. 6 of Regulations supplemental to Notice of Quarantine No. 56.—*U.S. Dept. Agric., B.P.Q., Q.*56, 2 pp. Washington, D.C., 1st August 1933.

Further slight alterations are made to the restrictions on the entry of fruits and vegetables into the United States from various countries to prevent the introduction of certain injurious insects [*cf. R.A.E.*, A, xi, 518 ; xii, 14, 117 ; xiii, 239, etc.].

McDaniel (E. I.). **Propylene Dichloride Mixture controls Clothes-moths and Carpet-beetles in Rugs and Over-stuffed Furniture.**—*Quart. Bull. Mich. Agric. Expt. Sta.*, xvi, no. 1, pp. 13–15. East Lansing, Mich., August 1933.

A brief account is given of the activities of clothes moths and carpet beetles in rugs and upholstered furniture [*cf. R.A.E.*, A, xv, 630 ; xix, 95]. They can be controlled by fumigating with a mixture of propylene dichloride and carbon tetrachloride (90 : 10), applied at considerable pressure with a spray gun. One U.S. gallon was used for a large divan or for a 9×12 ft. rug, and at least ½ U.S. gal. for a large chair. Immediately after treatment, the articles should be covered to prevent the escape of fumes and left for 24 hours. Before replacing treated carpets and rugs, the floors should be scrubbed and polished. The spray should also be injected into any protected place where larvae may be hidden. It may be necessary to repeat this treatment every 3–6 months, as it does not prevent reinfestation.

Papers noticed by Title only.

Kontkanen (P.). **Zur Kenntnis der Gattung** *Phaedon* **Latr. (Col., Chrysom.)**. [Notes on the Classification of the Genus *Phaedon*.]—*Ann. Soc. zool.-bot. fenn. Vanamo*, xiv, no. 3, pp. 67–74, 6 figs., 17 refs. Helsingfors, 1933.

Mimeur (J. M.). **Aphididae du Maroc (Deuxième note)** [*Rungsia graminis*, gen. et sp. n., on grasses and cereals].—*Bull. Soc. Sci. nat. Maroc*, xiii, no. 1–3, pp. 104–108, 2 figs., 1 ref. Rabat, 1933. [*Cf. R.A.E.*, A, xix, 733.]

Metalnikov (S.) & Metalnikov, Jr. (S. S.). **Utilisation des méthodes bactériologiques dans la lutte contre les insectes nuisibles au cotonnier** (*Gelechia* [*Platyedra*] *gossypiella* **Saund.**) [in Egypt].—*Coton et Cult. cotonn.*, 1933, reprint 13 pp., 1 pl., 2 figs., 42 refs. Paris, 1933. [*Cf. R.A.E.*, A, xxi, 365.]

Hutson (J. C.). **The Rhinoceros or Black Beetle of Coconuts** [*Oryctes rhinoceros*, L.].—*Trop. Agriculturist*, lxxxi, no. 2, pp. 125–128, 1 pl., (*Leafl. Dept. Agric. Ceylon*, no. 21, revd.). Peradeniya, August 1933. [*Cf. R.A.E.*, A, x, 582.]

Hazelhoff (E. H.). **Investigations on the White Top-Borer** [*Scirpophaga intacta*, Sn., on sugar-cane in Java].—*Bull. Int. Soc. Sugar Cane Technol.*, no. 66, 8 pp., 2 graphs. San Juan, P. R., March 1932. [Recd. Oct. 1933.] [*Cf. R.A.E.*, A, xviii, 703 ; xix, 568.]

SONAN (J.). **On the Tribe Rhyssini Cush. & Rohw. from Formosa (Hym. Ichneumonidae)** [including *Epirhyssa hyblaeana*, sp. n., reared from pupa of *Hyblaea puera*, Cram.].—*Trans. Nat. Hist. Soc. Formosa*, xxiii, no. 126–127, pp. 242–248, 8 figs. Taihoku, Formosa, August 1933.

KUWANA (I.). **I. The Diaspine Coccidae of Japan, vii. II. Key to Genera of Diaspinae in Japan. III. An Index to Species of Coccids recorded in the Diaspine Coccidae of Japan, i-vii.**—*Sci. Bull. Minist. Agric. For. Japan*, no. 3, 51 pp., 11 pls. Tokyo, August 1933. [Conclusion of *R.A.E.*, A, xix, 400, etc.]

AMOS (J. M.). **A List of the Coccidae of Tippecanoe County and their Hosts (Homoptera).**—*Proc. Indiana Acad. Sci.*, xlii (1932), pp. 205–208. Indianapolis, Ind., 1933.

AMOS (J. M.). **Descriptions of Coccidae** [5 species] **heretofore unrecorded from Indiana (Homoptera).**—*Proc. Indiana Acad. Sci.*, xlii (1932), pp. 208–211, 6 figs. Indianopolis, Ind., 1933.

SCHMIEDER (R. G.). **The Polymorphic Forms of** *Melittobia chalybii* **Ashmead and the determining Factors involved in their Production (Hymenoptera : Chalcidoidea, Eulophidae).**—*Biol. Bull.*, lxv, no. 2, pp. 338–354, 4 figs., 7 refs. Lancaster, Pa., October 1933.

ROARK (R. C.). **An Index of Chemicals mentioned in the Review of United States Patents relating to Pest Control issued in 1931.**—33 pp. multigraph. Washington, D.C., October 1933. [*Cf. R.A.E.*, A, xix, 680 ; xx, 192.]

HALLER (H. L.). **Rotenone. XXV. The Synthesis of Tetrahydrotubanol and Tetrahydrotubaic Acid.**—*J. Amer. Chem. Soc.*, lv, pp. 3032–3035, 5 refs. Easton, Pa., 1933.

LAFORGE (F. B.). **Rotenone. XXVI. Synthesis of the Parent Substances of some characteristic Rotenone Derivatives.**—*T.c.*, pp. 3040–3048, 14 figs., 11 refs.

HALLER (H. L.) & SCHAFFER (P. S.). **Rotenone. XXVII. Note on the Hydrogenation of Rotenone.**—*T.c.*, pp. 3494–3495, 1 fig., 6 refs.

HALLER (H. L.) & SCHAFFER (P. S.). **Rotenone. XXVIII. Preparation of Dihydrorotenone.**—*Industr. Engng. Chem.*, xxv (p. 983), reprint 3 pp., 6 refs. Easton, Pa., September 1933.

GROSS (C. R.). **Sources of Error in the Gutzeit Method for the Determination of Arsenic.**—*J. Ass. Off. Agric. Chem.*, xvi, no. 3, pp. 398–403, 1 fig., 2 refs. Washington, D.C., August 1933.

CLARK (E. P.). **An electrically heated Sand Bath.**—*J. Ass. Off. Agric. Chem.*, xvi, no. 3, pp. 418–420, 1 fig. Washington, D.C., August 1933.

MOULTON (D.). **The Thysanoptera of South America (IV).**—*Rev. Ent.*, iii, no. 3, pp. 385–419, 4 figs. Rio de Janeiro, 25th September 1933. [*Cf. R.A.E.*, A, xxi, 568.]

VEITCH (R.). **The History of Economic Entomology in Australia.**—*Queensland Agric. J.*, xl, pt. 2, pp. 94–97 ; also as *Ent. Leafl. Dept. Agric. Queensland*, no. 27, 6 pp., Brisbane, 1933.

INDEX OF AUTHORS.

A reference in heavy type indicates that a paper by the author has been abstracted.

GENERAL INDEX.

In the case of scientific names the page reference is cited only under the heading of the generic name.

When a generic name is printed in brackets, it signifies that the name is not the one adopted.

A.

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K.

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M.

N.

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P.

Q.

R.

S.

T.

U.

V.

W.